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January 24, 1997

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SOUTH

Mr. Brian Farrier
CERCLA PA/SI Regional Project Officer
USEPA Region IV
100Alabama Street, S. W.
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Dear Mr. Farrier:

Enclosed you will find a Preliminary Assessment report for the following:

SOUTHSIDE WASTE WATER TREATMENT PLANT

Should you have any questions, please do not hesitate to contact our office.

Sincerely,

Jymalyn E. Redmond

Jymalyn E. Redmond, Chief
Site Assessment Unit

JER/tpc

NFRAP APPROVED
BJ 2/11/97

PRELIMINARY ASSESSMENT
AUBURN SOUTHSIDE WASTEWATER TREATMENT PLANT
AUBURN, LEE COUNTY, ALABAMA
EPA ID No.: AL0001409192
CERCLIS SITE REF. No. 6477

Prepared By
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Land Division - Hazardous Waste Branch
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Office of Education

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Date:	***January 15, 1997***
Prepared by:	***Bonnie L. Temple and Kathleen K. Moss(Site Investigators) Site Assessment Unit, ADEM - Land Division - Hazardous Waste Branch and Pollution Prevention Unit, ADEM - Office of Education***
Site:	***Auburn Southside Wastewater Treatment Plant Auburn, Lee County, Alabama 36830***
EPA ID No.:	***AL0001409192***
CERCLIS No.:	***6477***

1. INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA) and a cooperative agreement between the U.S. Environmental Protection Agency and the Alabama Department of Environmental Management (ADEM), a Preliminary Assessment (PA) was conducted at the former Auburn Southside Wastewater Treatment Plant on Shug Jordan Parkway in Auburn, Lee County, Alabama. The purpose of this investigation was to collect information concerning conditions at the site sufficient to assess the threat posed to human health and the environment and to determine the need for additional investigation under CERCLA/SARA or other action. The scope of the investigation included a review of available file information, a comprehensive target survey and an onsite reconnaissance.

2. SITE DESCRIPTION, SITE HISTORY, AND WASTE CHARACTERISTICS

2.1 Location

The Auburn Southside Wastewater Treatment Plant (Southside Waste Treatment Facility, Auburn Wastewater Treatment Facility, South Side Sewage Treatment Plant, ASWWTP) is located southwest of downtown Auburn, Alabama (Fig. 1-3; Att. 1). The inactive facility lies to the east of Shug Jordan Parkway (Hwy 267), 0.5 miles north of its junction with South College (US 29/147N) and adjacent to Parkerson Mill Creek in Auburn, Alabama 36830. The site lies in the Northeast 1/4 of the Southeast 1/4 of the Southwest 1/4 of Section 36; Township 19 North; Range 25 East, Lee County, Alabama (Att. 1). The inactive facility is further located at latitude 32°35' 13.0" and longitude 85°30'2.0" (Ref.. 2).

Lee County is characterized by a mild temperate climate (Att. 2). The average temperature in winter is 45° F and the average summer temperature is 77° F. The annual precipitation for Lee County at 58 inches (Ref. 3).

2.2 Site Description

ASWWTP is not fenced; therefore, it is accessible to the public from an old entrance road off of Shug Jordan Parkway (Fig. 3; Att. 3-4). In 1994 the facility underwent a partial demolition. The clarifiers have been demolished and covered with soil (Att. 6). Grasses and small shrubs predominate the majority of the 6.8 acres. The northwestern edge of the site is bounded by Parkerson Mill Creek. Older trees and dense shrubs dominate the stream banks. The old box culvert for the outfall is located at the stream bank. At least one of the clarifier tanks and a building seem to have been located in the primary flood plain of the creek. The property slopes down toward the creek with the high point on the eastern corner of the property. A copy of the Site Grading and Drainage plan for the City of Auburn's South Side Sewage Treatment Plant, is included (Att. 5). Auburn University operates a hog farm north of ASWWTP along Parkerson Mill Creek and its oil recycling facility to the east (Fig. 1-3; Att. 1)

2.3 Waste Characteristics and Site History

The ASWWTP site was deeded to the City of Auburn for usage as a sewage treatment facility (Att. 6). Once the treatment facility ceased operations, the property reverted back to Auburn University. Therefore, at the present time Auburn University is the owner of the property, and their address is ETV Annex Telecom Building, Auburn, Alabama 36849-5423. The City of Auburn is currently the operator, and their address is 171 Ross Street, Auburn, AL 36831. According to City of Auburn officials, Auburn University's oil recycling facility had an large waste oil spill, prior to 1985, which flowed across ASWWTP's property and into Parkerson Mill Creek (Att. 6).

General flow of sewage through the facility is by gravity feed and appears to be as follows (Att. 6-7, 10):

1. Raw sewage coming into the facility flows through a cominuter/barminuter into the primary clarifier.
2. The solids from the clarifier pass into the digester and the liquids flow into the primary filter.
3. The primary filter liquids flow into the secondary filter which passes its load to the final clarifier.
4. The final clarifier passes its liquid to the chlorinator, and its solids back to the digester to be recycled.
5. After chlorination, the treated sewage outflow passes to the stream at the facility's concrete box culvert.

ASWWTP was a trickling filter sewage system built in 1958 and closed in December of 1985 (Att. 7-8). The system had three trickle arm apparatuses--primary filter with two arms and secondary filter with a single arm (Att. 5). All were designed to contain approximately 40 to 45 pounds of mercury in a fitting on which the trickling arms rotated. During demolition of ASWWTP in the spring of 1994, the city discovered and reported that the mercury was missing in two of the three trickling arm fittings of the two filter tanks (Att. 6-8). The potential exists for eighty pounds of mercury to have escaped from the two trickling arms in the primary filter tank. The facility design should have contained the spills in either the facility piping or at the bottom of a 100 foot diameter five foot deep concrete structure filled with large crushed stone (rip rap) (Ref. 4).

Partial environmental cleanup and sampling occurred at ASWWTP in 1994 (Att. 8). According to the Weston Report, soil samples from the sludge drying beds (2), the degritting tank (1) and the primary discharge point (1) detected acceptable levels of arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium and silver but elevated TPH levels. Details listing sample depth and methodology are unknown. Forty-three pounds of mercury was collected from the secondary filter's trickling arm (Att. 6-7). Approximately two pounds of mercury was collected from one of the two trickling arm fittings for the primary filter. The fittings were vacuumed to remove the small beads of mercury that remained on the metal surfaces of the fittings. ADEM Special Projects issued an emergency ID number (ALTMP0001573) for the mercury and contaminated soil so it could be transported to a landfill or recycler for disposal. Heritage Environmental Services, Inc. of Charlotte, NC received 1 55-gallon drum of mercury contaminated soil, ball bearings contaminated with mercury and debris, and elemental mercury (Att. 7-8). The TPH contaminated soils were taken to Salem Waste Disposal Center's Landfill in Opelika, Alabama (Att. 6). According to the Weston Report, the only water sample that exceeded the Maximum Contaminant Levels (MCLs) was from the "Secondary Digester Aeration Arm" which was 9 times MCL (SWTF-W-02: Mercury 0.018 mg/L; MCL: 0.002 mg/L)(Att. 8). According the City of Auburn, there are no aeration arms on the digesters only the filters (Att. 6). The rip rap filter rock has been partially removed to fill in depressions along the area roadbeds.

Even after the fittings had been vacuumed, small beads of mercury continue to bleed out of the rusted metal fittings (Att. 4). It is possible that the mercury leaked out of the drain plug on the side of the fitting and drained through the rip rap to the bottom of the concrete filter. The contaminated metal fittings and pipes are sizable, each weighing several thousand pounds.

There was no information for ASWWTP located in the Air Division, Water Division (Groundwater, Industrial Branch), Land Division, or Sara Title III files.

3. GROUND WATER PATHWAY

3.1 Hydrogeologic Setting

Lee County is underlain by metamorphic and igneous rocks that range in age from Precambrian to Triassic (Att. 2). These rocks are overlain by sedimentary sand, gravel, and clay of Cretaceous age in the southern part of the county, and by alluvial deposits of Pleistocene and Holocene age in and adjacent to stream valleys (Scott & Lines, 1972).

> Outcropping metamorphic and igneous rocks trend northeastward through the county. Foliation planes of metamorphic rocks dip southeastward in the southern part of the county and northwestward in the northern part. The rocks consist mainly of quartzite, marble, mylonite, amphibolite, granite, and several varieties of gneiss and schist. The rocks are deeply weathered and, as a result, a weathered mantle of saprolite (unconsolidated material and soil) has developed through the decomposition and weathering of underlying bedrock. Saprolite generally is thicker in valleys and draws than on hilltops. The thickest saprolite in the county is associated with quartzite, marble, schist, and gneiss in the central part of the county (Scott & Lines, 1972).

The ASWWTP Site is located near the contact of the Manchester Schist. This area is considered to be part of the Pine Mountain Block of the Southern Piedmont lithotectonic province and is described by Raymond, et. al, as follows:

The Pine Mountain block is bounded on the north by the northwest edge of the Towaliga fault zone and on the south by the Bartletts Ferry fault of the Goat Rock fault zone. The block includes the cataclastic rocks of the Towaliga fault zone on the northwest, an older basement schist and gneiss complex (Wacoochee Complex), and a younger metasedimentary sequence of quartzite, marble, and aluminous schist (Pine Mountain Group).

The Towaliga fault zone is a 4.5 to 6.0-mile-wide zone of cataclastic rock along the northwest side of the Pine Mountain block and represents, in part, the sheared limbs of overturned nappes. Rocks within the fault zone include mylonite, blastomylonite, mylonite gneiss, mylonite schist, mylonite quartzite, microbreccia, and scattered tectonic slices of the quartzite-marble-schist sequence of the Pine Mountain Group. The main movement zone of the Towaliga fault bounds a large slice of Pine Mountain rock (Manchester schist) whereas with the Towaliga fault zone are thin, isolated fragments of nappe limbs composed of Pine Mountain rock. Units within the fault zone generally dip steeply northwest but locally the dip is vertical or steep to the southeast. Minor folds within the fault zone suggest a late folding episode subsequent to major tectonic movement.

Southeast of the Towaliga fault zone is the Pine Mountain block proper. Basement rocks of the Pine Mountain block consist of three poorly exposed highly deformed units of feldspathic schist and gneiss of the Wacoochee Complex: the Halawaka Schist, the Whatley Mill Gneiss, and the Phelps Creek Gneiss. The Halawaka Schist and the Whatley Mill Gneiss are highly deformed and appear to represent original basement rock. The Phelps Creek Gneiss appears to have intruded the Halawaka contemporaneously with latter stages of deformation but prior to deposition of the overlying Pine Mountain metasedimentary sequence. Much of the gneiss has feldspar augen as much as 10 inches in diameter. Pegmatites and granitic dikes are common. Radiometric age dates of gneiss in the Pine Mountain block in Georgia indicate a 1.1 billion years old basement.

The overlying younger metasedimentary sequence, the Pine Mountain Group, consists of: the Hollis Quartzite, Chewacla Marble, and Manchester Schist. The Hollis Quartzite is composed mostly of well-sorted quartz and contains minor amounts of muscovite, microcline, and sulfide minerals. The Chewacla Marble is fine- to coarse-grained light-gray dolomitic marble typically containing flow folds. Overlying the marble is the Manchester Schist, which is composed of a lower graphitic aluminous schist and biotite schist unit, a middle quartzite unit similar to the Hollis Quartzite, and an upper unit of biotite-muscovite-quartz schist and feldspathic schist. Locally, the entire sequence has been injected with granite dikes and pegmatites.

Most of the east-central section of the state is underlain by igneous and metamorphic rocks whose age, structure and stratigraphic relations are not well understood. Within this area lies several major faults, lines of metamorphic discontinuities and structural discontinuities resulting from the movement of one metamorphic rock over another. These rocks are made up of clastic sediments that have been altered by several stages of regional metamorphism to slate, schist, phyllite, quartzite, gneiss and marble (Kidd, 1989).

Recharge areas for the aquifers in Lee County are the same as the outcrop area for the various igneous and metamorphic rocks. Because of the small yields of wells completed in these rocks, none of them are considered major aquifers. Movement of groundwater within the aquifers is controlled by topography, thickness of the saprolite and the size, number and pattern of the fractures in the crystalline bedrock. The direction of groundwater movement is primarily controlled by topography i.e. from uplands to lowlands. Rainfall infiltrates the saprolite, which slowly recharges the fractures in the underlying bedrock. The amount and rate of recharge is dependent upon the thickness and nature of the saprolite (Kidd, 1989).

According to Kidd, 1989,

> Fractures in rock generally decrease in size and in number with depth, and interconnecting fractures rarely occur at depths greater than 200 feet. The fractures in the bedrock of the aquifer may be joints, openings along planes of schistocity, or other openings such as fault planes or fault zones. The dip of the schistocity controls the direction of seepage and the degree and depth of weathering. Most fractures in the study area are steeply dipping to vertical and generally have definite alignments. The fractures in bedrock, enlarged by weathering and solution, are probably the avenues along which the greatest amounts of groundwater move in aquifers.

The igneous and metamorphic aquifer is susceptible to contamination throughout its outcrop area. This susceptibility is lessened by the thickness of the soils and saprolite. Valleys and lowlands where the water table is near the surface have an increased susceptibility. Major fault zones are highly susceptible to contamination due to their highly transmissive nature and may be areas of increased recharge (Kidd, 1989).

Rocks of the igneous and metamorphic aquifer generally yield less than 25 gallons per minute to wells and as such are not extensively used for public water supply, industry or irrigation. The towns of Auburn and Opelika use surface water as their principle source of water. According, to Kidd, 1989, there are no public water supply wells within 4 miles of the ASWWTP Site. One well, located near Chewacla State Park was formerly used as a public supply well for the City of Auburn. This well is not currently being used for public water supplies.

Private water supply wells were present within 4 miles of the subject site during the survey conducted as part the construction of the Geological Survey of Alabama Map 131 and accompanying publication. While this publication was printed in 1972, private water supply wells are expected to still be in use within 4 miles of the ASWWTP Site.

Shallow groundwater at the ASWWTP Site is expected to move in the direction of the local surface water i.e. to the southeast to south. Deeper groundwater within the bedrock may be more difficult to predict without additional information but should generally move to the south.

Due to the limited amount of water that is obtainable from individual wells in the area, the majority of water used for public supplies is obtained from surface sources. It was estimated in 1985, that approximately 0.88 million gallons per day of groundwater was used in Lee County for public water supply. This is primarily from private water supply wells. Some of these private wells may be present within 4 miles of the ASWWTP Site.

3.2 Ground Water Targets

Due to the limited amount of water that is obtainable from individual wells in the area, the majority of water in the radius of review used for drinking water is obtained from surface sources. The towns of Auburn and Opelika use surface water as their principle source of water (Att. 11). It is estimated in 1987, that approximately 0.55 million gallons per day of groundwater was used in Lee County.

3.3 Groundwater Conclusions

Due to the weight of the liquid mercury and its limited migration potential, contamination of local groundwater is not suspected.

4. SURFACE WATER PATHWAY

4.1 Hydrologic Setting

The ASWWTP Site is within the Southern Piedmont Upland physiographic section (Att. 1-2). This section has rolling topography indicative of a dissected peneplain of advanced erosional maturity. Altitudes vary from about 500 to 900 feet above mean sea level (MSL). Surface elevations at the site are estimated to be 580 to 630 feet above MSL, and the slope is approximately 6 to 10 percent to the southeast and south. The property along the stream, where the clarifier tanks appear to have been located, lies in the 100-year floodplain (Att. 9). The remainder of the property lies outside the 100-year or 500-year floodplain.

4.2 Surface Water Targets

The Possible Point of Entry (PPE) is located at the western edge of the ASWWTP property at the outfall (Fig. 1-3; Att. 1-3). Parkerson Mill Creek flows 1.82 miles south until it reaches the first of two wetlands. The stream flows through Wetland #1 which consist of 0.55 frontage miles. The stream continues to flow south until it reaches Chewacla Creek 4.91 miles from PPE. Wetland #2 lies along Chewacla Creek 7.18 miles from the PPE. Wetland #2 consists of 0.14 frontage miles (Total wetland miles is 0.69 miles). The remaining 15 downstream miles lies along Chewacla Creek which flows to Uphapee Creek further downstream. There are no surface water intakes located along the 15 downstream miles (Att. 1).

Parkerson Mill Creek and Chewacla Creek have 2 year-7 day low flows of 0.0 cfs and 2.3 cfs respectively (Att. 11; Table 2). Parkerson Mill Creek and Chewacla Creek (from Chewacla State Park Lake to Uphapee Creek) are classified as "Fish and Wildlife" (Ref. 14).

Of the 17 Federally Endangered or Threatened Species identified for this area, 3 species may occur along the banks of the Alabama River system, Parkerson Mill Creek, and Chewacla Creek (Att. 12-14; Ref. 18). These waters might be critical to the support of many threatened and endangered terrestrial species (see list of terrestrial species in Section 5.2). The Table 1 below lists the aquatic wildlife that is thought to have a high probability of being exposed to contaminants from the ASWWTP site if contaminants were to enter into the surface water pathway:

Table 1:	**Aquatic, Federally Endangered or Threatened Species**	
Common Name	**Listing**	**Distribution in Alabama**
Fine-lined pocketbook mussel	Threatened	Macon County; Alabama River drainage
Ovate clubshell mussel	Endangered	Macon County; Statewide
Southern clubshell mussel	Endangered	Macon County; Statewide except Mobile Delta/Alabama River drainage

(Att. 12-14; Ref. 18)

4.3 Surface Water Conclusion

There is a possibility that the missing mercury collected in the pipes between the primary filter and the digestor and/or secondary filter. Weston's stream sediment samples do not indicate mercury contamination of the stream. Therefore, it is unlikely that the mercury passed through the entire treatment system and reached the stream.

5. SOIL EXPOSURE AND AIR PATHWAY

5.1 Physical Conditions

Soils at the ASWWTP Site have been classified by the Soil Conservation Service as Pacolet sandy loam, 6 to 10 percent slopes (Att. 2). They are moderately deep, well drained soils that have developed on narrow ridgetops and side slopes of the Piedmont Plateau.

The typical soil sequence consists of 3 inches of reddish brown sandy loam. The subsoil is yellowish red sandy clay loam to a depth of 7 inches, red clay to a depth of 26 inches, and red clay loam to a depth of 34 inches. The underlying material is mottled yellow, brown, and red soft saprolite. The soil is strongly acid or very strongly acid and the natural fertility is low. The permeability is moderate and the potential for erosion is moderate to severe if cultivated crops are grown. (McNutt, 1981).

5.2 Soil and Air Targets

ASWWTP lies within the corporate limits of the City of Auburn (Fig. 1-3; Att. 1, 3-4). The area surrounding ASWWTP is rural with Auburn University's hog farm lying to the north, Auburn University's oil recycling facility lying to the east, and Auburn University's Beef Cattle Evaluation Unit lying to the west across Shug Jordan Parkway. No residences were noted in the immediate area. ASWWTP is an inactive facility but at the present the property is being utilized for storage of materials. There are no known primary or secondary schools or day care facilities within 200 feet of the area. Auburn University's hog farm may have students present at the facility (potential 10 workers). The nearest school is Auburn Junior High School which lies 1.45 miles south of ASWWTP (Table 2; Att. 1, 15). Due to the rural nature of the lands within the radius of review, not only ranching but agricultural activities would be likely to occur (Fig. 1; Att. 1).

TABLE 2:	**DATA ON SCHOOL SYSTEMS AND DIRECTION AUBURN SOUTHSIDE WASTEWATER TREATMENT PLANT (ASWWTP)**		
Distance Ring	**School Name**	**Direction from ASWWTP**	**Population of School**
0.0-1.0	None	NA	0
1.0-2.0	Auburn Jr. High School	E	691
	Wrights Mill Elem School	E	540
2.0-3.0	Auburn High School	E	1,182
	Cary Woods Elem. School	N	505
	Dean Road Elem. School	E	497
	Drake Middle School	N	717
3.0-4.0	None	NA	0
Total Number of Schools: 6		Total Population:	4,132

(Att. 1, 15)

According to the Alabama 1990 census records for Lee County, there are 2.5 persons per household (Ref. 20). In Table 3, the total population within the target area has been broken down into sub-populations that live within each specified distance radius from the site:

Table 3:	Estimated Population
Distance From Site	Population
0.00-0.25	10
0.25-0.50	25
0.50-1.0	348
1.0-2.0	9,044
2.0-3.0	10,246
3.0-4.0	2,253
Total Population	**21,926**

(Att. 1; Ref. 20)

Within the 4-mile area of concern and the 15-mile surface water pathway, there are two known wetlands comprising 0.69 total wetland miles (Att. 1). It is not known if the ASWWTP site is a critical habitat for any of the 14 terrestrial federally designated endangered or threatened species, but the Table 4 below list the terrestrial species that may utilize the land and surface waters located within the specified target areas.

Table 4:	Terrestrial, Federally Endangered or Threatened Species	
Common Name	Listing	Distribution in Alabama
Florida Panther	Endangered	Statewide
Red Wolf	Endangered	Statewide
Indiana Bat	Endangered	Lee and Macon Counties
American Peregrine Falcon	Endangered/Critical Habitat	Statewide
Arctic Peregrine Falcon	Threatened	Statewide
Bachman's Warbler	Endangered	Statewide/Probably Extirpated
Bald Eagle	Endangered	Statewide
Eskimo Curlew	Endangered	Statewide
Ivory Billed Woodpecker	Endangered	Extirpated Statewide
Red-cockaded woodpecker	Endangered	Lee County; Statewide
Wood Stork	Endangered	Statewide
American Burying Beetle	Endangered	Statewide
Alabama Canebrake Pitcher Plant	Endangered	Central Alabama
Relict Trillium	Endangered	Lee County

(Att. 12-14; Ref. 18)

5.3 Soil Exposure and Air Pathway Conclusion

There is a possibility that the mercury may have escaped into the soil from the pipes between the primary filter and the digestor and/or secondary filter, but the mercury may be trapped in the facility's pipes.

6. SUMMARY AND CONCLUSIONS

Mercury utilized in the trickling arms of the filters was noted as missing in 1994 during demolition of the ASWWTP facility. According to Weston, this mercury has not been located in soil/sediment samples or in the surface water of Parkerson Mill Creek. Some mercury aat the site has been recovered and properly disposed of at a permitted facility. No evaluations have been conducted to detemine if the facility may have contributed to the known groundwater contamination in the area. The valves between the treatment units have been closed; therefore, there is a strong possibility that the mercury is trapped in the facility pipes between treatment units and may not have impacted the environment. Based on the limited number of target populations, we recommend that no further study of the site be conducted by the federal Superfund Program for Auburn Southside Wastewater Treatment Plant. However, further evaluation and cleanup of the site may be necessary at the state level.

7. REFERENCES

1. U.S.G.S. 7.5 Minute Series Topographic Quadrangle Maps of Alabama: Auburn, Alabama, 1971 (Photorevised 1983); Little Texas, Alabama, 1971; Loachapoka, Alabama, 1971 (Photorevised 1983); Opelika West, Alabama, 1971 (Photorevised 1983); Society Hill, Alabama, 1971 (Photorevised 1985); Waverly, Alabama, 1971. Scale 1:24,000.

2. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Computer Program Latitude and Longitude Calculation for Auburn Southside Wastewater Treatment Plant, Alabama, AL0001409192, Ref. No. 6477, December 1996.

3. Lovoy, David M., ADEM, Water Division, Preliminary Assessment - Groundwater, Auburn Wastewater Treatment Facility, Alabama, AL0001409192, Ref. No. 6477, August 13, 1996.

4. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Trip Report for Auburn Southside WWTP, Auburn, Alabama, AL0001409192, Ref. No. 6477, Trip date: December 9, 1996.

5. Temple, Bonnie L. and Jerremy H. Stamps, ADEM, Land Division, Hazardous Waste Branch, Photo-documentation Log for Auburn Southside Wastewater Treatment Plant, Alabama, AL0001409192, Ref. No. 6477, Trip dates: April 5, 1994 and December 9, 1996.

6. Converse, J. B. & Co., Inc., Engineers, Blueprints entitled: "Site Grading & Drainage" and "Secondary Filter" for City of Auburn, Alabama, South Side Sewage Treatment Plant, February 1958 and February 1958/December 12, 1960.

7. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Personal Communication with City of Auburn, Auburn, Alabama, December 18, 1996 through January 15, 1997.

8. ADEM, Land Division, Hazardous Waste Branch (Special Project's files), Auburn Southside WWTP, Auburn, Alabama, AL0001409192, Ref. No. 6477, March 15, 1994 through April 22, 1994.

9. Weston, Roy F., Inc., "Contaminated Soil Management Plant, Southside Waste Treatment Facility, Auburn, Alabama 36830," Work Order No. 02871-005-001-0002-05, August, 24, 1994.

10. Steel, Ernest W., Water Supply and Sewage, Fourth Edition, McGraw-Hill Book Company, Inc., New York, 1960.

11. Alabama Department of Environmental Management, Federal Reporting Data System (FRS-II), Public Water Supply Summary. Municipal Drinking Water Supplies serving the communities in the vicinity of Auburn Southside Wastewater Treatment Plant, Auburn, Alabama.

12. Federal Emergency Management Agency, Flood Insurance Rate Maps, City of Auburn, Alabama, Lee County, Community Panel Numbers Map Index and 0101440059, Effective dates: May 17, 1993 and September 16, 1981, respectively.

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13. Hayes, Eugene C., Geological Survey of Alabama, 1978, 7-Day Low Flows and Flow Duration of Alabama Streams Through 1973. Geological Survey of Alabama Bulletin 113.

14. ADEM, Water Division - Water Quality Program, 1993, Water Use Classification for Interstate and Intrastate Waters, Chapter 335-6-11.

15. U.S. Fish and Wildlife Service, "Endangered Species By County List," April 1994.

16. State of Alabama, Department of Conservation and Natural Resources, "Alabama Federally Listed Endangered/Threatened Species," October 16, 1991.

17. U.S. Fish and Wildlife Service, Endangered and Threatened Species of the Southeast United States (The Red Book). Prepared by Ecological Services, Division of Endangered Species, Southeast Region. Government Printing Office, Washington, D. C. (two volumes), 1992.

18. Teem, David H., et al., Alabama Agricultural Experiment Station, 1986, Vertebrate Animals of Alabama in Need of Special Attention.

19. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Telephone Conversation with Auburn City Schools, December 16, 1996.

20. Alabama State Data Center, Center for Business and Economic Research, College of Commerce and Business Administration, The University of Alabama. 1990 CENSUS Alabama Counties and Cities By Race.

7. ATTACHMENTS

1. U.S.G.S. 7.5 Minute Series Topographic Quadrangle Maps of Alabama: Auburn, Alabama, 1971 (Photorevised 1983); Little Texas, Alabama, 1971; Loachapoka, Alabama, 1971 (Photorevised 1983); Opelika West, Alabama, 1971 (Photorevised 1983); Society Hill, Alabama, 1971 (Photorevised 1985); Waverly, Alabama, 1971. Scale 1:24,000.

2. Lovoy, David M., ADEM, Water Division, Preliminary Assessment - Groundwater, Auburn Wastewater Treatment Facility, Alabama, AL0001409192, Ref. No. 6477, August 13, 1996.

3. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Trip Report for Auburn Southside WWTP, Auburn, Alabama, AL0001409192, Ref. No. 6477, Trip date: December 9, 1996.

4. Temple, Bonnie L. and Jerremy H. Stamps, ADEM, Land Division, Hazardous Waste Branch, Photo-documentation Log for Auburn Southside Wastewater Treatment Plant, Alabama, AL0001409192, Ref. No. 6477, Trip dates: April 5, 1994 and December 9, 1996.

5. Converse, J. B. & Co., Inc., Engineers, Blueprints entitled: "Site Grading & Drainage" and "Secondary Filter" for City of Auburn, Alabama, South Side Sewage Treatment Plant, February 1958 and February 1958/December 12, 1960.

6. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Personal Communication with City of Auburn, Auburn, Alabama, December 18, 1996 through January 15, 1997.

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8. Weston, Roy F., Inc., "Contaminated Soil Management Plant, Southside Waste Treatment Facility, Auburn, Alabama 36830," Work Order No. 02871-005-001-0002-05, August, 24, 1994.

9. Steel, Ernest W., Water Supply and Sewage, Fourth Edition, McGraw-Hill Book Company, Inc., New York, 1960.

10. Federal Emergency Management Agency, Flood Insurance Rate Maps, City of Auburn, Alabama, Lee County, Community Panel Numbers Map Index and 0101440059, Effective dates: May 17, 1993 and September 16, 1981, respectively.

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12. U.S. Fish and Wildlife Service, "Endangered Species By County List," April 1994.

13. State of Alabama, Department of Conservation and Natural Resources, "Alabama Federally Listed Endangered/Threatened Species," October 16, 1991.

ATTACHMENTS CONTINUED (Page 2)

14. U.S. Fish and Wildlife Service, Endangered and Threatened Species of the Southeast United States (The Red Book). Prepared by Ecological Services, Division of Endangered Species, Southeast Region. Government Printing Office, Washington, D. C. (two volumes), 1992.

15. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Telephone Conversation with Auburn City Schools, December 16, 1996.

EPA

Potential Hazardous Waste Site Preliminary Assessment Form

Identification

State: AL

CERCLIS Number: AL0001409192

CERCLIS Discovery Date: 3/5/96

1. General Site Information

Name: Auburn Southside Wastewater Treatment Plant

Street Address: Shug Jordan Parkway

City: Auburn

State: AL | Zip Code: 36831 | County: Lee | Co. Code: 081 | Cong. Dist: 03

Latitude: N 32° 35' 13.0" | Longitude: W 85° 30' 02.0"

Approximate Area of Site: 6.8 Acres ____ Square Ft

Status of Site:
- ☐ Active
- ☒ Inactive
- ☐ Not Specified
- ☐ NA (GW plume, etc.)

2. Owner/Operator Information

Owner	Operator
Auburn University	City of Auburn
Street Address: ETV Annex Telecom Bldg.	Street Address: 171 Ross Street (PO Box 511)
City: Auburn	City: Auburn
State: AL; Zip Code: 36849-5423; Telephone: (334) 844-4000	State: AL; Zip Code: 36831; Telephone: (344) 821-1900

Type of Ownership:
- ☐ Private
- ☐ Federal Agency Name ____
- ☒ State
- ☐ Indian
- ☐ County
- ☐ Municipal
- ☐ Not Specified
- ☐ Other ____

How Initially Identified:
- ☐ Citizen Complaint
- ☐ PA Petition
- ☐ State/Local Program
- ☒ RCRA/CERCLA Notification
- ☐ Federal Program
- ☐ Incidental
- ☐ Not Specified
- ☐ Other ____

3. Site Evaluator Information

Name of Evaluator: Bonnie L. Temple, Kathleen K. Moss

Agency/Organization: ADEM

Date Prepared: Jan. 3, 1997

Street Address: 1751 Cong. WL Dickinson Dr.

City: Montgomery

State: AL

Name of EPA or State Agency Contact: Brian Farrier

Street Address: Atlanta Federal Center 100 Alabama Street, SW

City: Atlanta

State: GA

Telephone: (404) 562-8357

4. Site Disposition (for EPA use only)

Emergency Response/Removal Assessment Recommendation:
- ☐ Yes
- ☐ No

Date: ____

CERCLIS Recommendation:
- ☐ Higher Priority SI
- ☐ Lower Priority SI
- ☐ NFRAP
- ☐ RCRA
- ☐ Other ____

Date: ____

Signature:

Name (typed):

Position:

EPA Potential Hazardous Waste Site
Preliminary Assessment Form - Page 2 of 4

CERCLIS Number: AL0001409192

5. General Site Characteristics

Predominant Land Uses Within 1 Mile of Site (check all that apply):
- ☐ Industrial
- ☒ Commercial
- ☒ Residential
- ☒ Forest/Fields
- ☒ Agriculture
- ☐ Mining
- ☐ DOD
- ☐ DOE
- ☐ DOI
- ☐ Other Federal Facility
- ☒ Other Auburn Univ Vet School

Site Setting:
- ☐ Urban
- ☐ Suburban
- ☒ Rural

Years of Operation:
Beginning Year 1958
Ending Year 1985
☐ Unknown

Type of Site Operations (check all that apply):
- ☐ Manufacturing (must check subcategory)
  - ☐ Lumber and Wood Products
  - ☐ Inorganic Chemicals
  - ☐ Plastic and/or Rubber Products
  - ☐ Paints, Varnishes
  - ☐ Industrial Organic Chemicals
  - ☐ Agricultural Chemicals (e.g., pesticides, fertilizers)
  - ☐ Miscellaneous Chemical Products (e.g., adhesives, explosives, ink)
  - ☐ Primary Metals
  - ☐ Metal Coating, Plating, Engraving
  - ☐ Metal Forging, Stamping
  - ☐ Fabricated Structural Metal Products
  - ☐ Electronic Equipment
  - ☐ Other Manufacturing
- ☐ Mining
  - ☐ Metals
  - ☐ Coal
  - ☐ Oil and Gas
  - ☐ Non-metallic Minerals
- ☐ Retail
- ☐ Recycling
- ☐ Junk/Salvage Yard
- ☐ Municipal Landfill
- ☐ Other Landfill
- ☐ DOD
- ☐ DOE
- ☐ DOI
- ☐ Other Federal Facility ______
- ☐ RCRA
  - ☐ Treatment, Storage, or Disposal
  - ☐ Large Quantity Generator
  - ☐ Small Quantity Generator
  - ☐ Subtitle D
    - ☐ Municipal
    - ☐ Industrial
  - ☐ "Converter"
  - ☐ "Protective Filer"
  - ☐ "Non- or Late Filer"
- ☐ Not Specified
- ☒ Other Municipal wastewater treatment plant

Waste Generated:
- ☒ Onsite
- ☐ Offsite
- ☐ Onsite and Offsite

Waste Deposition Authorized By:
- ☐ Present Owner
- ☐ Former Owner
- ☐ Present & Former Owner
- ☐ Unauthorized
- ☒ Unknown

Waste Accessible to the Public:
- ☒ Yes
- ☐ No

Distance to Nearest Dwelling, School, or Workplace:
200 Feet

6. Waste Characteristics Information

Source Type: (check all that apply)	Source Waste Quantity: (include units)	Tier*:
☐ Landfill		
☒ Surface Impoundment	100'd X5'h x.25	V
☐ Drums		
☐ Tanks and Non-Drum Containers		
☐ Chemical Waste Pile		
☒ Scrap Metal or Junk Pile	1 ton estimate	V
☐ Tailings Pile		
☐ Trash Pile (open dump)		
☐ Land Treatment		
☐ Contaminated Ground Water Plume (unidentified source)		
☐ Contaminated Surface Water/Sediment (unidentified source)		
☐ Contaminated Soil		
☒ Other spilled mercury	80 lbs Hg	C
☐ No Sources		

* C = Constituent, W = Wastestream, V = Volume, A = Area

General Types of Waste (check all that apply)
- ☒ Metals
- ☐ Organics
- ☐ Inorganics
- ☐ Solvents
- ☐ Paints/Pigments
- ☐ Laboratory/Hospital Waste
- ☐ Radioactive Waste
- ☐ Construction/Demolition Waste
- ☐ Pesticides/Herbicides
- ☐ Acids/Bases
- ☐ Oily Waste
- ☐ Municipal Waste
- ☐ Mining Waste
- ☐ Explosives
- ☐ Other ______

Physical State of Waste as Deposited (check all that apply):
- ☐ Solid
- ☐ Sludge
- ☐ Powder
- ☒ Liquid
- ☐ Gas

CERCLIS Number: AL0001409192

7. Ground Water Pathway

Is Ground Water Used for Drinking Water Within 4 Miles:
- ☐ Yes
- ☒ No

Type of Drinking Water Wells Within 4 Miles (check all that apply):
- ☐ Municipal
- ☐ Private
- ☒ None

Is There a Suspected Release to Ground Water:
- ☐ Yes
- ☒ No

Have Primary Target Drinking Water Wells Been Identified:
- ☐ Yes
- ☒ No

If Yes, Enter Primary Target Population: ______ People

List Secondary Target Population Served by Ground Water Withdrawn From:

0 - ¼ Mile	0
> ¼ - ½ Mile	0
> ½ - 1 Mile	0
> 1 - 2 Miles	0
> 2 - 3 Miles	0
> 3 - 4 Miles	0
Total Within 4 Miles	0

Depth to Shallowest Aquifer: 20 Feet

Karst Terrain/Aquifer Present:
- ☐ Yes
- ☒ No

Nearest Designated Wellhead Protection Area:
- ☐ Underlies Site
- ☐ > 0 - 4 Miles
- ☒ None Within 4 Miles

8. Surface Water Pathway

Type of Surface Water Draining Site and 15 Miles Downstream (check all that apply):
☒ Stream ☐ River ☐ Pond ☐ Lake ☐ Bay ☐ Ocean ☐ Other ______

Shortest Overland Distance From Any Source to Surface Water:
300 Feet
0.06 Miles

Is There a Suspected Release to Surface Water:
- ☐ Yes
- ☒ No

Site is Located in:
- ☐ Annual - 10 yr Floodplain
- ☐ > 10 yr - 100 yr Floodplain
- ☒ > 100 yr - 500 yr Floodplain
- ☐ > 500 yr Floodplain

Drinking Water Intakes Located Along the Surface Water Migration Path:
- ☐ Yes
- ☒ No

Have Primary Target Drinking Water Intakes Been Identified:
- ☐ Yes
- ☒ No

If Yes, Enter Population Served by Primary Target Intakes: ______ People

List All Secondary Target Drinking Water Intakes:

Name	Water Body	Flow (cfs)	Population Served
	NA		

Total within 15 Miles ______

Fisheries Located Along the Surface Water Migration Path:
- ☒ Yes
- ☐ No

Have Primary Target Fisheries Been Identified:
- ☐ Yes
- ☒ No

List All Secondary Target Fisheries:

Water Body/Fishery Name	Flow (cfs)
Parkerson Mill Creek	0
Chewacla Creek	2.3

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Potential Hazardous Waste Site
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CERCLIS Number: AL0001409192

8. Surface Water Pathway (continued)

Wetlands Located Along the Surface Water Migration Path:
- [x] Yes
- [ ] No

Have Primary Target Wetlands Been Identified:
- [ ] Yes
- [x] No

List Secondary Target Wetlands:

Water Body	Flow (cfs)	Frontage Miles
Parkerson Mill Creek	0	0.55
Chewacla Creek	2.3	0.14

Other Sensitive Environments Located Along the Surface Water Migration Path:
- [ ] Yes
- [x] No

Have Primary Target Sensitive Environments Been Identified:
- [ ] Yes
- [x] No

List Secondary Target Sensitive Environments:

Water Body	Flow (cfs)	Sensitive Environment Type
NA		

9. Soil Exposure Pathway

Are People Occupying Residences or Attending School or Daycare on or Within 200 Feet of Areas of Known or Suspected Contamination:
- [ ] Yes
- [x] No

If Yes, Enter Total Resident Population:

______ People

Number of Workers Onsite:
- [x] None
- [ ] 1 - 100
- [ ] 101 - 1,000
- [ ] >1,000

Have Terrestrial Sensitive Environments Been Identified on or Within 200 Feet of Areas of Known or Suspected Contamination:
- [ ] Yes
- [x] No

If Yes, List Each Terrestrial Sensitive Environment:

10. Air Pathway

Is There a Suspected Release to Air:
- [ ] Yes
- [x] No

Enter Total Population on or Within:

Onsite	0
0 - ¼ Mile	10
> ¼ - ½ Mile	25
> ½ - 1 Mile	348
> 1 - 2 Miles	9,044
> 2 - 3 Miles	10,246
> 3 - 4 Miles	2,253
Total Within 4 Miles	21,926

Wetlands Located Within 4 Miles of the Site:
- [x] Yes
- [ ] No

Other Sensitive Environments Located Within 4 Miles of the Site:
- [ ] Yes
- [x] No

List All Sensitive Environments Within ½ Mile of the Site:

Distance	Sensitive Environment Type/Wetlands Area (acres)
Onsite	NA
0 - ¼ Mile	
> ¼ - ½ Mile	

PA Scoresheets

Site Name: Auburn Southside Wastewater Treatment Plant

CERCLIS ID No.: AL 000 1409 192

Street Address: Shug Jordan Parkway

City/State/Zip: Auburn, AL 36830

Investigator: Kathleen K. Moss Bonnie L. Temple

Agency/Organization: ADEM

Street Address: 1751 Cong. WL Dickinson Dr.

City/State/Zip: Montgomery, AL 36109

Date: January 3, 1997

INSTRUCTIONS FOR SCORESHEETS

Introduction

This scoresheets package functions as a self-contained workbook providing all of the basic tools to apply collected data and calculate a PA score. Note that a computerized scoring tool, "PA-Score," is also available from EPA (Office of Solid Waste and Emergency Response, Directive 9345.1-11). The scoresheets provide space to:

- Record information collected during the PA
- Indicate references to support information
- Select and assign values ("scores") for factors
- Calculate pathway scores
- Calculate the site score

Do not enter values or scores in shaded areas of the scoresheets. You are encouraged to write notes on the scoresheets and especially on the Criteria Lists. On scoresheets with a reference column, indicate a number corresponding to attached sources of information or pages containing rationale for hypotheses; attach to the scoresheets a numbered list of these references. Evaluate all four pathways. Complete all Criteria Lists, scoresheets, and tables. Show calculations, as appropriate. If scoresheets are photocopy reproduced, copy and submit the numbered pages (right-side pages) only.

GENERAL INFORMATION

Site Description and Operational History: Briefly describe the site and its operating history. Provide the site name, owner/operator, type of facility and operations, size of property, active or inactive status, and years of waste generation. Summarize waste treatment, storage, or disposal activities that have or may have occurred at the site; note also if these activities are documented or alleged. Identify probable source types and prior spills. Summarize highlights of previous investigations.

Probable Substances of Concern: List hazardous substances that have or may have been stored, handled, or disposed at the site, based on your knowledge of site operations. Identify the sources to which the substances may be related. Summarize any existing analytical data concerning hazardous substances detected onsite, in releases from the site, or at targets.

GENERAL INFORMATION

Site Description and Operational History:

The Auburn Southside Wastewater Treatment Plant (ASWWTP) is located southwest of downtown Auburn, Alabama east of Shug Jordan Parkway. The inacative 6.8 acre ASWWTP site is not fenced and accessible to the public (Fig. 3; Att. 3-4). In 1994 the facility underwent a partial demolition. The facility is bounded by Parkerson Mill Creek, Auburn University's hog farm, and Auburn University's oil recycling facility. The property drains toward the creek (Fig. 1-3; Att. 1). At least two structures seem to have been located in the primary floodplain of the creek. The ASWWTP site was deeded to the City of Auburn for usage as a sewage treatment facility while active(Att. 6). Auburn University is the owner of the property, and the City of Auburn is currently the operator. Auburn University's oil recycling facility had an large waste oil spill which flowed across ASWWTP's property and into Parkerson Mill Creek (Att. 6).

The general flow of sewage through the facility is by gravity feed (Att. 6-7, 10). ASWWTP operated from 1958 to December of 1985 (Att. 7-8). The system had three trickle arm apparatuses--primary filter with 2 arms and secondary filter with a single arm (Att. 5). During demolition of ASWWTP in the spring of 1994, the city discovered and reported that the mercury was missing in 2 of the 3 trickling arm fittings of the 2 filter tanks (approx. 40 to 45 lbs of mercury/trickling arm)(Att. 6-8). The facility design should have contained the spills in either the facility pipes or at the bottom of a 100 ft. diameter 5 ft. deep concrete structure filled with large crushed stone (rip rap)(Ref. 4). Partial environmental cleanup and sampling occurred at ASWWTP in 1994 (Att. 8). Soil samples from the sludge drying beds (2), the degritting tank (1) and the primary discharge point (1) detected acceptable levels of arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium and silver but elevated TPH levels. 43 lbs of mercury was collected from the secondary filter's trickling arm (Att. 6-7). Approx. 2 lbs of mercury was collected from 1 of the 2 trickling arm fittings for the primary filter. The fittings were vacuumed to remove the small beads of mercury that remained on the metal surfaces of the fittings. ADEM Special Projects issued an emergency ID number (ALTMP0001573) for the mercury for transport to a landfill or recycler for disposal. Heritage Environmental Services, Inc. of.Charlotte, NC received 1 55-gallon drum of mercury contaminated soil, ball bearings contaminated with mercury and debris, and elemental mercury (Att. 7-8). The TPH contaminated soils were taken to Salem Waste Disposal Center's Landfill in Opelika, Alabama (Att. 6). The only water sample that exceeding the MCLs was from the "Secondary Digester Aeration Arm" which was 9 times MCL (SWTF-W-02: Mercury 0.018 mg/L; MCL: 0.002 mg/L)(Att. 8). The rip rap filter rock has been partially removed for roadside construction. Small beads of mercury are still being observed bleeding out of the rusted metal fittings and have been observed on the rocks surrounding the primary filter fitting (Att. 4). Mercury may have leaked out of the drain plug on the side of the fitting and drained through the rip rap to the bottom of the concrete filter.

Probable Substances of Concern:
(Previous investigations, analytical data)

The potential exists for 80 lbs of mercury to have escaped from the 2 trickling arms in the primary filter tank (Ref. 4). Partial environmental cleanup and sampling occurred at ASWWTP in 1994 (Att. 8). Wastes removed: 1 55-gallon drum of mercury contaminated soil, ball bearings contaminated with mercury and debris, and elemental mercury (Att. 7-8). The TPH contaminated soils were taken to Salem Waste Disposal Center's Landfill in Opelika, Alabama (Att. 6). Small beads of mercury are still being observed bleeding out of the rusted metal fittings and have been observed on the rocks surrounding the primary filter fitting previously found to be empty of its mercury (Att. 4). The contaminated metal fittings and pipes are sizable, each weighing several thousand pounds. .Mercury may have leaked out and drained through the rip rap to the bottom of the concrete filter. Some of the rip rap filter rock has been removed to fill in depressions along the area roadbeds

GENERAL INFORMATION (continued)

Site Sketch: Prepare a sketch of the site (freehand is acceptable). Indicate all pertinent features of the site and nearby environs, including: waste sources, buildings, residences, access roads, parking areas, drainage patterns, water bodies, vegetation, wells, sensitive environments, etc.

Site Sketch:
(Show all pertinent features, indicate sources and closest targets, indicate north)

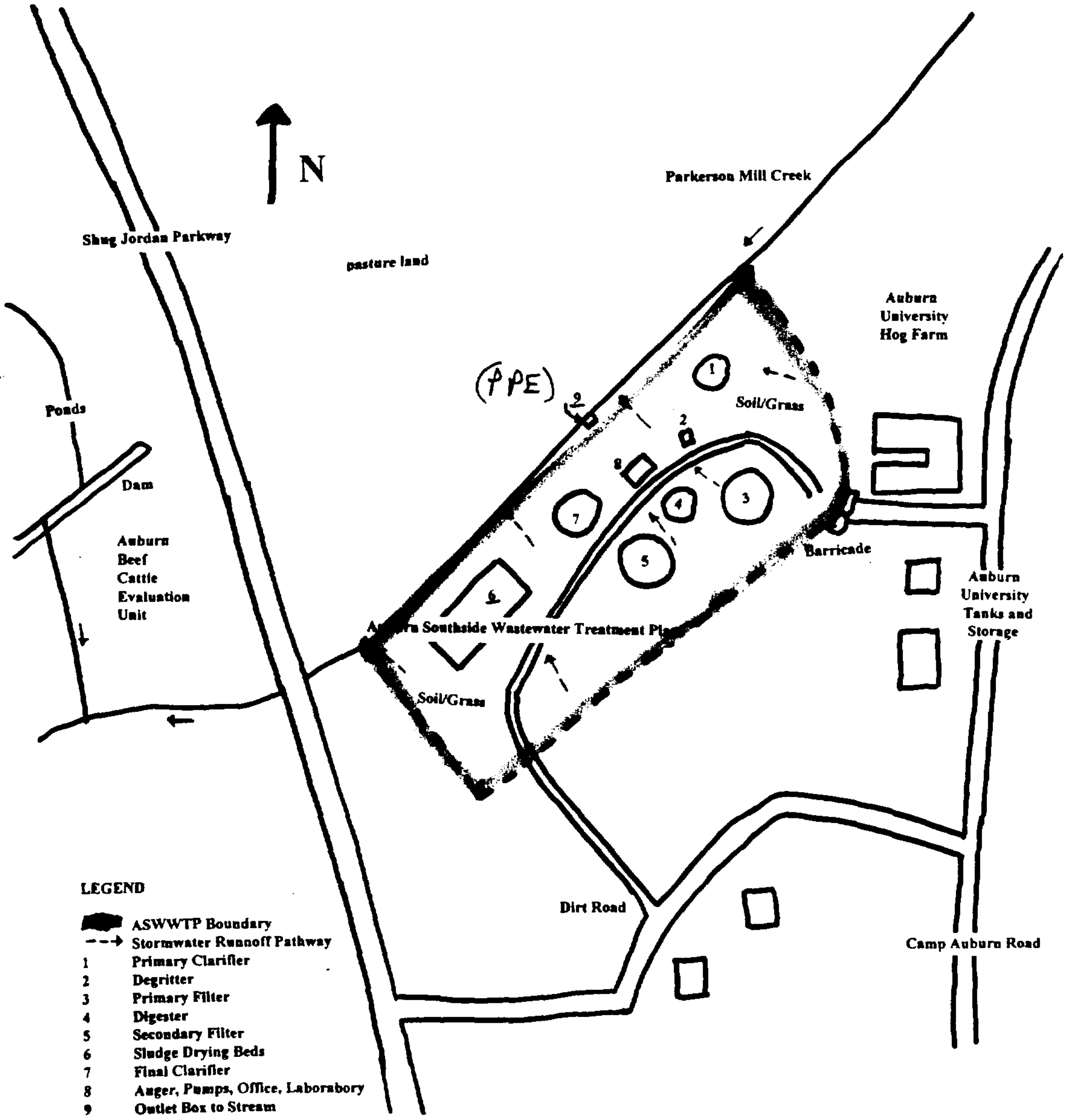

FIGURE 3: Auburn Southside Wastewater Treatment Plant Site Sketch Showing Estimated Location of Structures
– Not To Scale –

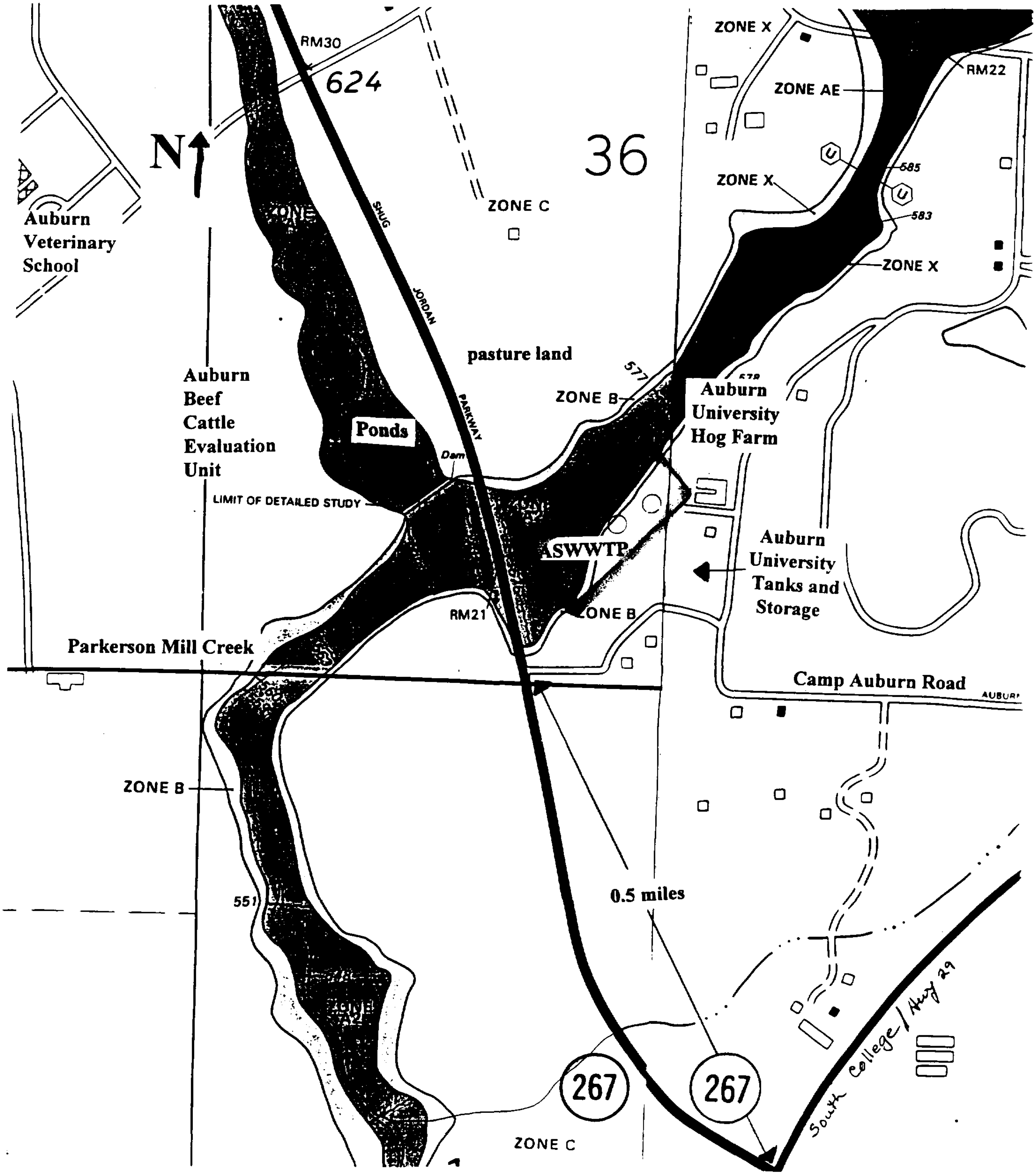

FIGURE 2: ASWWTP and Vicinity Site Sketch
City of Auburn: Comm. Panel 010144-0059D
– Not To Scale –

SOURCE EVALUATION

- Number and name each source (e.g., 1. East Drum Storage Area, 2. Sludge Lagoon, 3. Battery Pile).
- Identify source type according to the list below.
- Describe the physical character of each source (e.g., dimensions, contents, waste types, containment, operating history).
- Show waste quantity (WQ) calculations for each source for appropriate tiers. Refer to instructions opposite page 5 and PA Tables 1a and 1b. Identify waste quantity tier and waste characteristics (WC) factor category score (for a site with a single source, according to PA Table 1a). Determine WC from PA Table 1b for the sum of source WQs for a multiple-source site.
- Attach additional sheets if necessary.
- Determine the site WC factor category score and record at the bottom of the page.

Source Type Descriptions

__Landfill__: an engineered (by excavation or construction) or natural hole in the ground into which wastes have been disposed by backfilling, or by contemporaneous soil deposition with waste disposal, covering wastes from view.

2 __Surface Impoundment__: a topographic depression, excavation, or diked area, primarily formed from earthen materials (lined or unlined) and designed to hold accumulated liquid wastes, wastes containing free liquids, or sludges that were not backfilled or otherwise covered during periods of deposition; depression may be dry if deposited liquid has evaporated, volatilized or leached, or wet with exposed liquid; structures that may be more specifically described as lagoon pond, aeration pit, settling pond, tailings pond, sludge pit, etc.; also a surface impoundment that has been covered with soil after the final deposition of waste materials (i.e., buried or backfilled). (Spill is assumed contained in concrete filter with drainage bricks in the bottom)

__Drums__: portable containers designed to hold a standard 55-gallon volume of wastes.

__Tanks and Non-Drum Containers__: any stationary device, designed to contain accumulated wastes, constructed primarily of fabricated materials (such as wood, concrete, steel, or plastic) that provide structural support; any portable or mobile device in which waste is stored or otherwise handled.

__Contaminated Soil__: soil onto which available evidence indicates that a hazardous substance was spilled, spread, disposed, or deposited.

3 __Pile__: any non-containerized accumulation above the ground surface of solid, non-flowing wastes; includes open dumps. Some types of piles are: __Chemical Waste Pile__ -- consists primarily of discarded chemical products, by-products, radioactive wastes, or used or unused feedstocks; __Scrap Metal or Junk Pile__ -- consists primarily of scrap metal or discarded durable goods such as appliances, automobiles, auto parts, or batteries, composed of materials suspected to contain or have contained a hazardous substance; __Tailings Pile__ -- consists primarily of any combination of overburden from a mining operation and tailings from a mineral mining, beneficiation, or processing operation; __Trash Pile__ -- consists primarily of paper, garbage, or discarded non-durable goods which are suspected to contain or have contained a hazardous substance. (rusted trickle arm fittings & pipes containing mercury)

__Land Treatment__: landfarming or other land treatment method of waste management in which liquid wastes or sludges are spread over land and tilled, or liquids are injected at shallow depths into soils.

1 __Other__: a source that does not fit any of the descriptions above; examples include contaminated building, ground water plume with no identifiable source, storm drain, dry well, and injection well.
(spilled mercury)

SOURCE EVALUATION

Source No.: 1	Source Name: Constituent - Spilled Mercury	Source Waste Quantity (WQ) Calculations:
Source Description: Abandoned Auburn Southside Wastewater Treatment Plant. Mercury was discovered missing from two of three trickle arm apparatus.		Between 80-90 lbs of mercury escaped. Most should have collected at the bottom of the impoundment and in the fitting and arm pipes Most should be able to be collected 80 lbs $\frac{80}{1} = \boxed{80\ WQ}$

Source No.: 2	Source Name: filter tank rip rap	Source Waste Quantity (WQ) Calculations:
Source Description: (1) Some mercury may have contaminated the rip rap through which it traveled before settling at the bottom. (2) Since the source of mercury was centrally located, it is doubtful that all the rip rap is contaminated.		Conservatively, 25% of total rip rap is calculated as contaminated Volume = $(\pi r^2 \times h) \times 25\%$ $\frac{3.14 \times 50^2 \times 15}{4} = \frac{39,250}{4} = 9812.5$ cu ft $\frac{9,813.\text{ cu ft}}{67.5} = 145.37$ $\boxed{145.4\ WQ}$

Source No.: 3	Source Name: Metal fittings/pipes	Source Waste Quantity (WQ) Calculations:
Source Description: the metal pipes and fittings became rusted and, in the heat of the summer days, liquid mercury beads up in the flaking metal parts		pipes & metal fittings Two ton estimate each (x2) = 4 tons = 8,000 lbs $\boxed{2000\text{ lbs} = 1\ yd^3 \text{ or } 4\text{ tons} = 4\ yd^3}$ $\frac{4\ yd^3}{2.5} = \boxed{1.6\ WQ}$

total WQ = 80 + 145.4 + 1.6 = $\boxed{227\ WQ}$ → **Site WC:** 32

WASTE CHARACTERISTICS (WC) SCORES

WC, based on waste quantity, may be determined by one or all of four measures called "tiers": constituent quantity, wastestream quantity, source volume, and source area. PA Table 1a (page 5) is divided into these four tiers. The amount and detail of information available determine which tier(s) to use for each source. For each source, evaluate waste quantity by as many of the tiers as you have information to support, and select the result that gives you the highest WC score. If minimal, incomplete, or no information is available regarding waste quantity, assign a WC score of 18 (minimum).

PA Table 1a has 6 columns: column 1 indicates the quantity tier; column 2 lists source types for the four tiers; columns 3, 4, and 5 provide ranges of waste amount for sites with only one source, which correspond to WC scores at the top of the columns (18, 32, or 100); column 6 provides formulas to obtain source waste quantity (WQ) values at sites with multiple sources.

To determine WC for sites with only one source:

1. ***Identify source type (see descriptions opposite page 4).***
2. ***Examine all waste quantity data available.***
3. ***Estimate the mass and/or dimensions of the source.***
4. ***Determine which quantity tiers to use based on available source information.***
5. ***Convert source measurements to appropriate units for each tier you can evaluate for the source.***
6. ***Identify the range into which the total quantity falls for each tier evaluated (PA Table 1a).***
7. ***Determine the highest WC score obtained for any tier (18, 32, or 100, at top of PA Table 1a columns 3, 4, and 5, respectively).***
8. ***Use this WC score for all pathways.****

To determine WC for sites with multiple sources:

1. ***Identify each source type (see descriptions opposite page 4).***
2. ***Examine all waste quantity data available for each source.***
3. ***Estimate the mass and/or dimensions of each source.***
4. ***Determine which quantity tiers to use for each source based on the available information.***
5. ***Convert source measurements to appropriate units for each tier you can evaluate for each source.***
6. ***For each source, use the formulas in column 6 of PA Table 1a to determine the WQ value for each tier that can be evaluated. The highest WQ value obtained for any tier is the WQ value for the source.***
7. ***Sum the WQ values for all sources to get the site WQ total.***
8. ***Use the site WQ total from step 7 to assign the WC score from PA Table 1b.***
9. ***Use this WC score for all pathways.****

---

* The WC score is considered in all four pathways. However, if a primary target is identified for the ground water, surface water, or air migration pathway, assign the determined WC or a score of 32, whichever is greater, as the WC score for that pathway.

PA TABLE 1: WASTE CHARACTERISTICS (WC) SCORES

PA Table 1a: WC Scores for Single Source Sites and Formulas for Multiple Source Sites

TIER	SOURCE TYPE	SINGLE SOURCE SITES (assigned WC scores) WC = 18	WC = 32	WC = 100	MULTIPLE SOURCE SITES Formula for Assigning Source WQ Values
CONSTITUENT	N/A	≤100 lb	>100 to 10,000 lb	>10,000 lb	*lb ÷ 1*
WASTESTREAM	N/A	≤500,000 lb	>500,000 to 50 million lb	>50 million lb	*lb ÷ 5,000*
VOLUME	Landfill	≤6.75 million ft^3 ≤250,000 yd^3	>6.75 million to 675 million ft^3 >250,000 to 25 million yd^3	>675 million ft^3 >25 million yd^3	*ft^3 ÷ 67,500* *yd^3 ÷ 2,500*
	Surface impoundment	≤6,750 ft^3 ≤250 yd^3	>6,750 to 675,000 ft^3 >250 to 25,000 yd^3	>675,000 ft^3 >25,000 yd^3	*ft^3 ÷ 67.5* *yd^3 ÷ 2.5*
	Drums	≤1,000 drums	>1,000 to 100,000 drums	>100,000 drums	*drums ÷ 10*
	Tanks and non-drum containers	≤50,000 gallons	>50,000 to 5 million gallons	>5 million gallons	*gallons ÷ 500*
	Contaminated soil	≤6.75 million ft^3 ≤250,000 yd^3	>6.75 million to 675 million ft^3 >250,000 to 25 million yd^3	>675 million ft^3 >25 million yd^3	*ft^3 ÷ 67,500* *yd^3 ÷ 2,500*
	Pile	≤6,750 ft^3 ≤250 yd^3	>6,750 to 675,000 ft^3 >250 to 25,000 yd^3	>675,000 ft^3 >25,000 yd^3	*ft^3 ÷ 67.5* *yd^3 ÷ 2.5*
	Other	≤6,750 ft^3 ≤250 yd^3	>6,750 to 675,000 ft^3 >250 to 25,000 yd^3	>675,000 ft^3 >25,000 yd^3	*ft^3 ÷ 67.5* *yd^3 ÷ 2.5*
AREA	Landfill	≤340,000 ft^2 ≤7.8 acres	>340,000 to 34 million ft^2 >7.8 to 780 acres	>34 million ft^2 >780 acres	*ft^2 ÷ 3,400* *acres ÷ 0.078*
	Surface impoundment	≤1,300 ft^2 ≤0.029 acres	>1,300 to 130,000 ft^2 >0.029 to 2.9 acres	>130,000 ft^2 >2.9 acres	*ft^2 ÷ 13* *acres ÷ 0.00029*
	Contaminated soil	≤3.4 million ft^2 ≤78 acres	>3.4 million to 340 million ft^2 >78 to 7,800 acres	>340 million ft^2 >7,800 acres	*ft^2 ÷ 34,000* *acres ÷ 0.78*
	Pile*	≤1,300 ft^2 ≤0.029 acres	>1,300 to 130,000 ft^2 >0.029 to 2.9 acres	>130,000 ft^2 >2.9 acres	*ft^2 ÷ 13* *acres ÷ 0.00029*
	Land treatment	≤27,000 ft^2 ≤0.62 acres	>27,000 to 2.7 million ft^2 >0.62 to 62 acres	>2.7 million ft^2 >62 acres	*ft^2 ÷ 270* *acres ÷ 0.0062*

1 ton = 2,000 lb = 1 yd^3 = 4 drums = 200 gallons

* Use area of land surface under pile, not surface area of pile.

PA Table 1b: WC Scores for Multiple Source Sites

WQ Total	*WC Score*
>0 to 100	18
>100 to 10,000	32
>10,000	100

← 227 WQ

GROUND WATER PATHWAY

Ground Water Use Description: Provide information on ground water use in the vicinity. Present the general stratigraphy, aquifers used, and distribution of private and municipal wells.

Calculations for Drinking Water Populations Served by Ground Water: Provide populations from private wells and municipal supply systems in each distance category. Show apportionment calculations for blended supply systems.

GROUND WATER PATHWAY
GROUND WATER USE DESCRIPTION

Describe Ground Water Use Within 4-miles of the Site:
(Describe stratigraphy, information on aquifers, municipal and/or private wells)

Recharge areas for the aquifers in Lee County are the same as the outcrop area for the various igneous and metamorphic rocks and are susceptible to contamination throughout its outcrop area (Att. 2, Ref. 11). Shallow groundwater at the ASWWTP Site is expected to move in the direction of the local surface water i.e. to the southeast to south. Deeper groundwater within the bedrock may be more difficult to predict without additional information but should generally move to the south. Rocks of the igneous and metamorphic aquifer generally yield less than 25 gallons per minute to wells and as such are not extensively used for public water supply, industry or irrigation. The towns of Auburn and Opelika use surface water as their principle source of water. According, to Kidd, 1989, there are no public water supply wells within 4 miles of the ASWWTP Site. One well, located near Chewacla State Park was formerly used as a public supply well for the City of Auburn. This well is not currently being used for public water supplies.

Due to the limited amount of water that is obtainable from individual wells in the area, the majority of water used for public supplies is obtained from surface sources. It was estimated in 1985, that approximately 0.88 million gallons per day of groundwater was used in Lee County for public water supply; and in 1987, that approximately 0.55 million gallons per day of groundwater was used in Lee County. This is primarily from private water supply wells. Some of these private wells may be present within 4 miles of the ASWWTP Site.

Calculations for Drinking Water Populations Served by Ground Water:

No public water wells
No private wells identified

Target Population Zero

GROUND WATER PATHWAY CRITERIA LIST

This "Criteria List" helps guide the process of developing hypotheses concerning the occurrence of a suspected release and the exposure of specific targets to a hazardous substance. The check-boxes record your professional judgment in evaluating these factors. Answers to all of the listed questions may not be available during the PA. Also, the list is not all-inclusive; if other criteria help shape your hypotheses, list them at the bottom of the page or attach an additional page.

The "Suspected Release" section identifies several site, source, and pathway conditions that could provide insight as to whether a release from the site is likely to have occurred. If a release is suspected, use the "Primary Targets" section to evaluate conditions that may help identify targets likely to be exposed to a hazardous substance. Record responses for the well that you feel has the highest probability of being exposed to a hazardous substance. You may use this section of the chart more than once, depending on the number of targets you feel may be considered "primary."

Check the boxes to indicate a "yes," "no," or "unknown" answer to each question. If you check the "Suspected Release" box as "yes," make sure you assign a Likelihood of Release value of 550 for the pathway.

GROUND WATER PATHWAY CRITERIA LIST

SUSPECTED RELEASE

Yes	No	Unk	
☐	☐	☒	Are sources poorly contained?
☐	☒	☐	Is the source a type likely to contribute to ground water contamination (e.g., wet lagoon)?
☐	☒	☐	Is waste quantity particularly large?
☒	☐	☐	Is precipitation heavy?
☐	☒	☐	Is the infiltration rate high?
☐	☒		Is the site located in an area of karst terrain?
☐	☒	☐	Is the subsurface highly permeable or conductive?
☐	☒	☐	Is drinking water drawn from a shallow aquifer?
☐	☒	☐	Are suspected contaminants highly mobile in ground water?
☐	☒	☐	Does analytical or circumstantial evidence suggest ground water contamination?
☐	☐		Other criteria? ______________________
☐	☒		**SUSPECTED RELEASE?**

PRIMARY TARGETS

Yes	No	Unk	
☐	☒	☐	Is any drinking water well nearby?
☐	☒	☐	Has any nearby drinking water well been closed?
☐	☒	☐	Has any nearby drinking water user reported foul-tasting or foul-smelling water?
☐	☒	☐	Does any nearby well have a large drawdown or high production rate?
☐	☒	☐	Is any drinking water well located between the site and other wells that are suspected to be exposed to a hazardous substance?
☐	☒	☐	Does analytical or circumstantial evidence suggest contamination at a drinking water well?
☐	☒	☐	Does any drinking water well warrant sampling?
☐	☐		Other criteria? ______________________
☐	☒		**PRIMARY TARGET(S) IDENTIFIED?**

Summarize the rationale for Suspected Release (attach an additional page if necessary):

It is unknown if any escaped mercury has leaked out of fittings and pipes into the ground.

Summarize the rationale for Primary Targets (attach an additional page if necessary):

GROUND WATER PATHWAY SCORESHEET

Pathway Characteristics

Answer the questions at the top of the page. Refer to the Ground Water Pathway Criteria List (page 7) to hypothesize whether you suspect that a hazardous substance associated with the site has been released to ground water. Record depth to aquifer (in feet): the difference between the deepest occurrence of a hazardous substance and the depth of the top of the shallowest aquifer at (or as near as possible) to the site. Note whether the site is in karst terrain (characterized by abrupt ridges, sink holes, caverns, springs, disappearing streams). Record the distance (in feet) from any source to the nearest well used for drinking water.

Likelihood of Release (LR)

1. **Suspected Release:** Hypothesize based on professional judgment guided by the Ground Water Pathway Criteria List (page 7). If you suspect a release to ground water, use only Column A for this pathway and do not evaluate factor 2.

2. **No Suspected Release:** If you do not suspect a release, determine score based on depth to aquifer or whether the site is in an area of karst terrain. If you do not suspect a release to ground water, use only Column B to score this pathway.

Targets (T)

This factor category evaluates the threat to populations obtaining drinking water from ground water. To apportion populations served by blended drinking water supply systems, determine the percentage of population served by each well based on its production.

3. **Primary Target Population:** Evaluate populations served by all drinking water wells that you suspect have been exposed to a hazardous substance released from the site. Use professional judgment guided by the Ground Water Pathway Criteria List (page 7) to make this determination. In the space provided, enter the population served by any wells you suspect have been exposed to a hazardous substance from the site. If only the number of residences is known, use the average county residents per household (rounded up to the next integer) to determine population served. Multiply the population by 10 to determine the Primary Target Population score. Note that if you do not suspect a release, there can be no primary target population.

4. **Secondary Target Population:** Evaluate populations served by all drinking water wells within 4 miles that you do not suspect have been exposed to a hazardous substance. Use PA Table 2a or 2b (for wells drawing from non-karst and karst aquifers, respectfully) (page 9). If only the number of residences is known, use the average county residents per household (rounded to the nearest integer) to determine population served. Circle the assigned value for the population in each distance category and enter it in the column on the far-right side of the table. Sum the far-right column and enter the total as the Secondary Target Population factor score.

5. **Nearest Well** represents the threat posed to the drinking water well that is most likely to be exposed to a hazardous substance. If you have identified a primary target population, enter 50. Otherwise, assign the score from PA Table 2a or 2b for the closest distance category with a drinking water well population.

6. **Wellhead Protection Area (WHPA):** WHPAs are special areas designated by States for protection under Section 1428 of the Safe Drinking Water Act. Local/State and EPA Regional water officials can provide information regarding the location of WHPAs.

7. **Resources:** A score of 5 can generally be assigned as a default measure. Assign zero only if ground water within 4 miles has no resource use.

Sum the target scores in Column A (Suspected Release) or Column B (No Suspected Release).

Waste Characteristics (WC)

8. **Waste Characteristics:** Score is assigned from page 4. However, if you have identified any primary target for ground water, assign either the score calculated on page 4 or a score of 32, whichever is greater.

Ground Water Pathway Score: Multiply the scores for LR, T, and WC. Divide the product by 82,500. Round the result to the nearest integer. If the result is greater than 100, assign 100.

GROUND WATER PATHWAY SCORESHEET

Pathway Characteristics	
Do you suspect a release (see Ground Water Pathway Criteria List, page 7)?	Yes ___ No X
Is the site located in karst terrain?	Yes ___ No X
Depth to aquifer:	20 ft
Distance to the nearest drinking water well:	≥4 miles

LIKELIHOOD OF RELEASE

	A Suspected Release	B No Suspected Release	References
1. **SUSPECTED RELEASE:** If you suspect a release to ground water (see page 7), assign a score of 550. Use only column A for this pathway.			
2. **NO SUSPECTED RELEASE:** If you do not suspect a release to ground water, and the site is in karst terrain or the depth to aquifer is 70 feet or less, assign a score of 500; otherwise, assign a score of 340. Use only column B for this pathway.		500	Att 1 Fig 1
LR =		500	

TARGETS

	A	B	References
3. **PRIMARY TARGET POPULATION:** Determine the number of people served by drinking water wells that you suspect have been exposed to a hazardous substance from the site (see Ground Water Pathway Criteria List, page 7). _______ people x 10 =			
4. **SECONDARY TARGET POPULATION:** Determine the number of people served by drinking water wells that you do NOT suspect have been exposed to a hazardous substance from the site, and assign the total population score from PA Table 2. Are any wells part of a blended system? Yes ___ No ___ If yes, attach a page to show apportionment calculations.		0	Att 2 Ref 11
5. **NEAREST WELL:** If you have identified a primary target population for ground water, assign a score of 50; otherwise, assign the Nearest Well score from PA Table 2. If no drinking water wells exist within 4 miles, assign a score of zero.		0	
6. **WELLHEAD PROTECTION AREA (WHPA):** If any source lies within or above a WHPA, or if you have identified any primary target well within a WHPA, assign a score of 20; assign 5 if neither condition holds but a WHPA is present within 4 miles; otherwise assign zero.		0	
7. **RESOURCES**		5	Att 1
T =		5	Fig 1-3

WASTE CHARACTERISTICS

	A	B
8. A. If you have identified any primary target for ground water, assign the waste characteristics score calculated on page 4, or a score of 32, whichever is GREATER; do not evaluate part B of this factor.		
B. If you have NOT identified any primary target for ground water, assign the waste characteristics score calculated on page 4.		32
WC =		32

GROUND WATER PATHWAY SCORE: $\frac{LR \times T \times WC}{82,500}$ (subject to a maximum of 100) **1.0**

$$\frac{500 \times 5 \times 32}{82,500} = \frac{80,000}{82,500} = 0.969 = 1.0$$

NA

PA TABLE 2: VALUES FOR SECONDARY GROUND WATER TARGET POPULATIONS

PA Table 2a: Non-Karst Aquifers

Distance from Site	Population	Nearest Well (choose highest)	Population Served by Wells Within Distance Category: 1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	Greater than 100,000	Population Value
0 to ¼ mile	____	20	1	2	5	16	52	163	521	1,633	5,214	16,325	____
> ¼ to ½ mile	____	18	1	1	3	10	32	101	323	1,012	3,233	10,121	____
> ½ to 1 mile	____	9	1	1	2	5	17	52	167	522	1,668	5,224	____
> 1 to 2 miles	____	5	1	1	1	3	9	29	94	294	939	2,938	____
> 2 to 3 miles	____	3	1	1	1	2	7	21	68	212	678	2,122	____
> 3 to 4 miles	____	2	1	1	1	1	4	13	42	131	417	1,306	____

Nearest Well = ____ Score = ____

PA Table 2b: Karst Aquifers

Distance from Site	Population	Nearest Well (use 20 for karst)	Population Served by Wells Within Distance Category: 1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	Greater than 100,000	Population Value
0 to ¼ mile	____	20	1	2	5	16	52	163	521	1,633	5,214	16,325	____
> ¼ to ½ mile	____	20	1	1	3	10	32	101	323	1,012	3,233	10,121	____
> ½ to 1 mile	____	20	1	1	3	8	26	82	261	816	2,607	8,162	____
> 1 to 2 miles	____	20	1	1	3	8	26	82	261	816	2,607	8,162	____
> 2 to 3 miles	____	20	1	1	3	8	26	82	261	816	2,607	8,162	____
> 3 to 4 miles	____	20	1	1	3	8	26	82	261	816	2,607	8,162	____

Nearest Well = ____ Score = ____

SURFACE WATER PATHWAY

Migration Route Sketch: Sketch the surface water migration pathway (freehand is acceptable) illustrating the drainage route and identifying water bodies, probable point of entry, flows, and targets.

SURFACE WATER PATHWAY
MIGRATION ROUTE SKETCH

Suface Water Migration Route Sketch:
(include runoff route, probable point of entry, 15-mile target distance limit, intakes, fisheries, and sensitive environments)

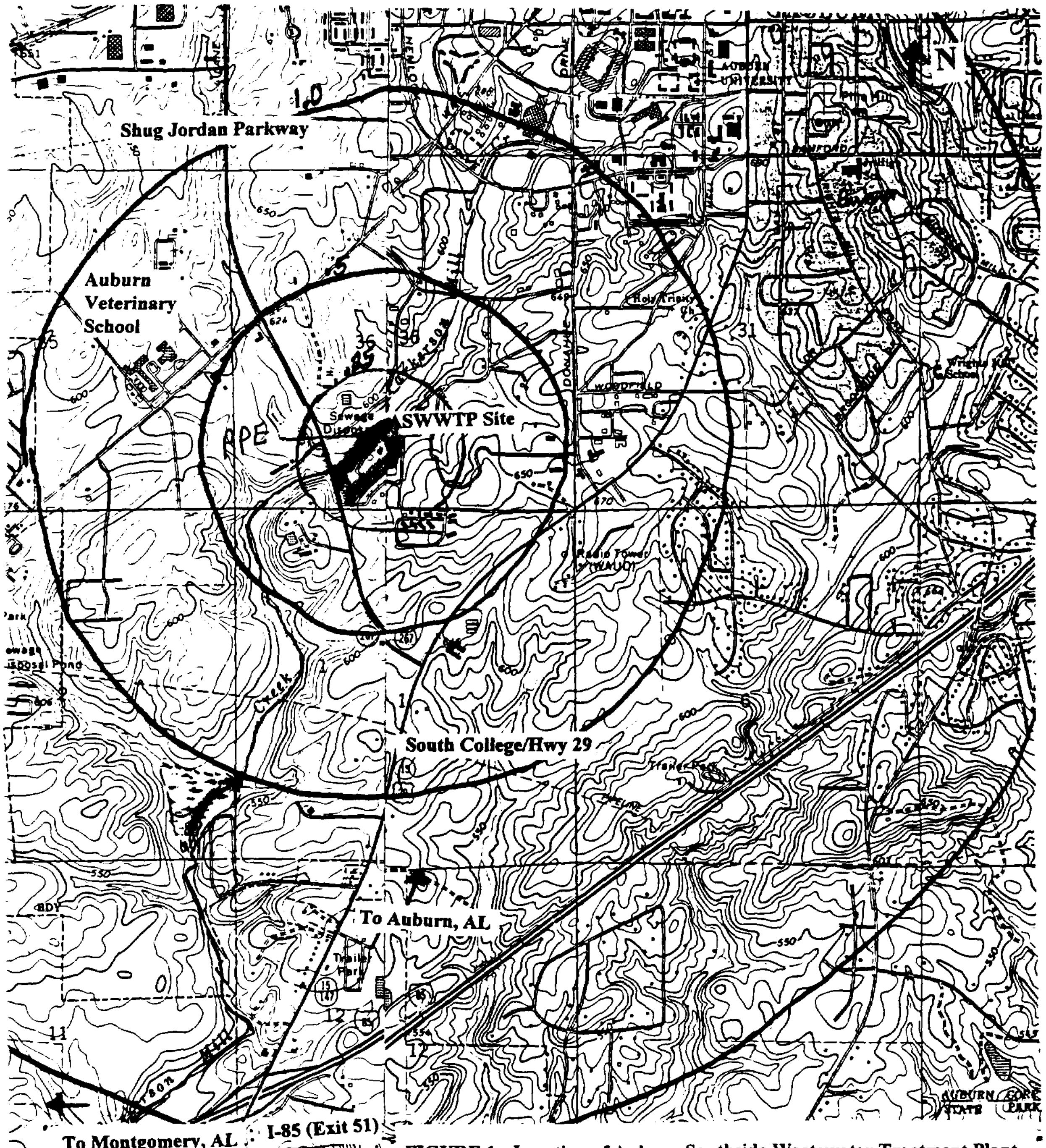

FIGURE 1: Location of Auburn Southside Wastewater Treatment Plant
7.5 Minute Quadrangle Maps (Loachapoka, AL and Auburn, AL)
– 1 Grid equals 1.0 mile –

SURFACE WATER PATHWAY CRITERIA LIST

This "Criteria List" helps guide the process of developing hypotheses concerning the occurrence of a suspected release and the exposure of specific targets to a hazardous substance. The check-boxes record your professional judgment in evaluating these factors. Answers to all of the listed questions may not be available during the PA. Also, the list is not all-inclusive; if other criteria help shape your hypotheses, list them at the bottom of the page or attach an additional page.

The "Suspected Release" section identifies several site, source, and pathway conditions that could provide insight as to whether a release from the site is likely to have occurred. If a release is suspected, use the "Primary Targets" section to guide you through evaluation of some conditions that may help identify targets likely to be exposed to a hazardous substance. Record responses for the target that you feel has the highest probability of being exposed to a hazardous substance. You may use this section of the chart more than once, depending on the number of targets you feel may be considered "primary."

Check the boxes to indicate a "yes," "no," or "unknown" answer to each question. If you check the "Suspected Release" box as "yes," make sure you assign a Likelihood of Release value of 550 for the pathway.

If the distance to surface water is greater than 2 miles, do not evaluate the surface water migration pathway. Document the source of information in the text boxes below the surface water criteria list.

SURFACE WATER PATHWAY CRITERIA LIST

SUSPECTED RELEASE

Yes	No	Unk	
☒	☐	☐	Is surface water nearby?
☐	☒	☐	Is waste quantity particularly large?
☐	☒	☐	Is the drainage area large?
☒	☐	☐	Is rainfall heavy?
☒	☐	☐	Is the infiltration rate low?
☐	☒	☐	Are sources poorly contained or prone to runoff or flooding?
☐	☒	☐	Is a runoff route well defined (e.g., ditch or channel leading to surface water)?
☐	☒	☐	Is vegetation stressed along the probable run-off route?
☐	☒	☐	Are sediments or water unnaturally discolored?
☐	☒	☐	Is wildlife unnaturally absent?
☐	☒	☐	Has deposition of waste into surface water been observed?
☐	☒	☐	Is ground water discharge to surface water likely?
☐	☒	☐	Does analytical or circumstantial evidence suggest surface water contamination?
☐	☐		Other criteria? ____________
☐	☒		**SUSPECTED RELEASE?**

Summarize the rationale for Suspected Release (attach an additional page if necessary):

PRIMARY TARGETS

Yes	No	Unk	
☒	☐	☐	Is any target nearby? If yes: ☐ Drinking water intake ☒ Fishery ☐ Sensitive environment
☐	☒	☐	Has any intake, fishery, or recreational area been closed?
☐	☒	☐	Does analytical or circumstantial evidence suggest surface water contamination at or downstream of a target?
☐	☒	☐	Does any target warrant sampling? If yes: ☐ Drinking water intake ☐ Fishery ☐ Sensitive environment
☐	☐		Other criteria? ____________
☐	☒		**PRIMARY INTAKE(S) IDENTIFIED?**
☐	☒		**PRIMARY FISHERY(IES) IDENTIFIED?**
☐	☒		**PRIMARY SENSITIVE ENVIRONMENT(S) IDENTIFIED?**

Summarize the rationale for Primary Targets (attach an additional page if necessary):

SURFACE WATER PATHWAY LIKELIHOOD OF RELEASE AND DRINKING WATER THREAT SCORESHEET

Pathway Characteristics

The surface water pathway includes three threats: Drinking Water Threat, Human Food Chain Threat, and Environmental Threat. Answer the questions at the top of the page. Refer to the Surface Water Pathway Criteria List (page 11) to hypothesize whether you suspect that a hazardous substance associated with the site has been released to surface water. Record the distance to surface water (the shortest overland drainage distance from a source to a surface water body). Record the flood frequency at the site (e.g., 100-yr, 200-yr). If the site is located in more than one floodplain, use the most frequent flooding event. Identify surface water use(s) along the surface water migration path and their distance(s) from the site.

Likelihood of Release (LR)

1. **Suspected Release:** Hypothesize based on professional judgment guided by the Surface Water Pathway Criteria List (page 11). If you suspect a release to surface water, use only Column A for this pathway and do not evaluate factor 2.

2. **No Suspected Release:** If you do not suspect a release, determine score based on the shortest overland drainage distance from a source to a surface water body. If distance to surface water is 2,500 feet or less, assign a score of 500. If distance to surface water is greater than 2,500 feet, determine score based on flood frequency. If you do not suspect a release to surface water, use only Column B to score this pathway.

Drinking Water Threat Targets (T)

3. List all drinking water intakes on downstream surface water bodies along the surface water migration path. Record the intake name, the type of water body on which the intake is located, the flow of the water body, and the number of people served by the intake (apportion the population if part of a blended system).

4. **Primary Target Population:** Evaluate populations served by all drinking water intakes that you suspect have been exposed to a hazardous substance released from the site. Use professional judgment guided by the Surface Water Pathway Criteria List (page 11) to make this determination. In the space provided, enter the population served by all intakes you suspect have been exposed to a hazardous substance from the site. If only the number of residences is known, use the average county residents per household (rounded up to the next integer) to determine population served. Multiply by 10 to determine the Primary Target Population score. Remember, if you do not suspect a release, there can be no primary target population.

5. **Secondary Target Population:** Evaluate populations served by all drinking water intakes within the target distance limit that you do not suspect have been exposed to a hazardous substance. Use PA Table 3 (page 13) and enter the population served by intakes for each flow category. If only the number of residences is known, use the average county residents per household (rounded to the nearest integer) to determine population served. Circle the assigned value for the population in each flow category and enter it in the column on the far-right side of the table. Sum the far-right column and enter the total as the Secondary Target Population factor score.

Gauging station data for many surface water bodies are available from USGS or other sources. In the absence of gauging station data, estimate flow using the list of surface water body types and associated flow categories in PA Table 4 (page 13). The flow for lakes is determined by the sum of flows of streams entering or leaving the lake. Note that the flow category "mixing zone of quiet flowing rivers" is limited to 3 miles from the probable point of entry.

6. **Nearest Intake** represents the threat posed to the drinking water intake that is most likely to be exposed to a hazardous substance. If you have identified a primary target population, enter 50. Otherwise, assign the score from PA Table 3 (page 13) for the lowest-flowing water body on which there is an intake.

7. **Resources:** A score of 5 can generally be assigned as a default measure. Assign zero only if surface water within the target distance limit has no resource use.

Sum the target scores in Column A (Suspected Release) or Column B (No Suspected Release).

SURFACE WATER PATHWAY
LIKELIHOOD OF RELEASE AND DRINKING WATER THREAT SCORESHEET

Pathway Characteristics	
Do you suspect a release (see Surface Water Pathway Criteria List, page 11)?	Yes ___ No X
Distance to surface water:	300 ft
Flood frequency:	100 yrs
What is the downstream distance to the nearest drinking water intake? >15 miles	
Nearest fishery? .06 miles Nearest sensitive environment? 61 miles	

LIKELIHOOD OF RELEASE

	A: Suspected Release	B: No Suspected Release	References
1. **SUSPECTED RELEASE:** If you suspect a release to surface water (see page 11), assign a score of 550. Use only column A for this pathway.	(550)		
2. **NO SUSPECTED RELEASE:** If you do not suspect a release to surface water, use the table below to assign a score based on distance to surface water and flood frequency. Use only column B for this pathway.		(500, 400, 300 or 100) 500	Att 1, 10 Fig 1-2
LR =		500	

Distance to surface water ≤ 2,500 feet	500
Distance to surface water > 2,500 feet, and	
Site in annual or 10-year floodplain	500
Site in 100-year floodplain	400
Site in 500-year floodplain	300
Site outside 500-year floodplain	100

DRINKING WATER THREAT TARGETS

3. Record the water body type, flow (if applicable), and number of people served by each drinking water intake within the target distance limit. If there is no drinking water intake within the target distance limit, factors 4, 5, and 6 each receive zero scores.

Intake Name	*Water Body Type*	*Flow*	*People Served*
		___ cfs	
		___ cfs	
		___ cfs	

	A	B	References
4. **PRIMARY TARGET POPULATION:** If you suspect any drinking water intake listed above has been exposed to a hazardous substance from the site (see Surface Water Pathway Criteria List, page 11), list the intake name(s) and calculate the factor score based on the total population served. ______, ______ ___ people x 10 =			
5. **SECONDARY TARGET POPULATION:** Determine the number of people served by drinking water intakes that you do NOT suspect have been exposed to a hazardous substance from the site, and assign the total population score from PA Table 3. Are any intakes part of a blended system? Yes ___ No ___ NA If yes, attach a page to show apportionment calculations.		0	Ref 11
6. **NEAREST INTAKE:** If you have identified a primary target population for the drinking water threat (factor 4), assign a score of 50; otherwise, assign the Nearest Intake score from PA Table 3. If no drinking water intake exists within the target distance limit, assign a score of zero.		0	
7. **RESOURCES**		5	Att 1
T =		5	

PA TABLE 3: VALUES FOR SECONDARY SURFACE WATER TARGET POPULATIONS

Surface Water Body Flow (see PA Table 4)	*Population*	*Nearest Intake (choose highest)*	*Population Served by Intakes Within Flow Category*											*Population Value*
			1 to 30	*31 to 100*	*101 to 300*	*301 to 1,000*	*1,001 to 3,000*	*3,001 to 10,000*	*10,001 to 30,000*	*30,001 to 100,000*	*100,001 to 300,000*	*300,001 to 1,000,000*	*Greater than 1,000,000*	
<10 cfs	______	20	2	5	16	52	163	521	1,633	5,214	16,325	52,136	163,246	______
10 to 100 cfs	______	2	1	1	2	5	16	52	163	521	1,633	5,214	16,325	______
>100 to 1,000 cfs	______	1	0	0	1	1	2	5	16	52	163	521	1,633	______
>1,000 to 10,000 cfs	______	0	0	0	0	0	1	1	2	5	16	52	163	______
>10,000 cfs or Great Lakes	______	0	0	0	0	0	0	0	1	1	2	5	16	______
3-mile Mixing Zone	______	10	1	3	8	26	82	261	816	2,607	8,162	26,068	81,623	______

Nearest Intake = ______

Score = ______

PA TABLE 4: SURFACE WATER TYPE / FLOW CHARACTERISTICS WITH DILUTION WEIGHTS FOR SECONDARY SURFACE WATER SENSITIVE ENVIRONMENTS

Type of Surface Water Body			*Dilution Weight*
Water Body Type	*OR*	*Flow*	
minimal stream		< 10 cfs	*1*
small to moderate stream		10 to 100 cfs	*0.1*
moderate to large stream		> 100 to 1,000 cfs	*N/A*
large stream to river		> 1,000 to 10,000 cfs	*N/A*
large river		> 10,000 cfs	*N/A*
3-mile mixing zone of quiet flowing streams or rivers		10 cfs or greater	*N/A*
coastal tidal water (harbors, sounds, bays, etc.), ocean, or Great Lakes		N/A	*N/A*

Patterson Mill Creek
Chewacla Creek

SURFACE WATER PATHWAY HUMAN FOOD CHAIN THREAT SCORESHEET

Likelihood of Release (LR)

LR is the same for all surface water pathway threats. Enter LR score from page 12.

Human Food Chain Threat Targets (T)

8. The only human food chain targets are fisheries. A fishery is an area of a surface water body from which food chain organisms are taken or could be taken for human consumption on a subsistence, sporting, or commercial basis. Food chain organisms include fish, shellfish, crustaceans, amphibians, and amphibious reptiles. Fisheries are delineated by changes in surface water body type (i.e., streams and rivers, lakes, coastal tidal waters, and oceans/Great Lakes) and whenever the flow characteristics of a stream or river change.

In the space provided, identify all fisheries within the target distance limit. Indicate the surface water body type and flow for each fishery. Gauging station flow data are available for many surface water bodies from USGS or other sources. In the absence of gauging station data, estimate flow using the list of surface water body types and associated flow categories in PA Table 4 (page 13). The flow for lakes is determined by the sum of flows of streams entering or leaving the lake. Note that, if there are no fisheries within the target distance limit, the Human Food Chain Threat Targets score is zero.

9. Primary fisheries are any fisheries within the target distance limit that you suspect have been exposed to a hazardous substance released from the site. Use professional judgment guided by the Surface Water Pathway Criteria List (page 11) to make this determination. If you identify any primary fisheries, list them in the space provided, enter 300 as the Primary Fisheries factor score, and do not evaluate Secondary Fisheries. Note that if you do not suspect a release, there can be no primary fisheries.

10. Secondary fisheries are fisheries that you do not suspect have been exposed to a hazardous substance. Evaluate this factor only if fisheries are present within the target distance limit, but none is considered a primary fishery.

A. If you suspect a release to surface water and have identified a secondary fishery but no primary fishery, assign a score of 210.

B. If you do not suspect a release, evaluate this factor based on flow. In the absence of gauging station flow data, estimate flow using the list of surface water body types and associated flow categories in PA Table 4 (page 13). Assign a Secondary Fisheries score from the table on the scoresheet using the lowest flow at any fishery within the target distance limit. (Dilution weight multiplier does not apply to PA evaluation of this factor.)

Sum the target scores in Column A (Suspected Release) or Column B (No Suspected Release).

SURFACE WATER PATHWAY (continued)
HUMAN FOOD CHAIN THREAT SCORESHEET

LIKELIHOOD OF RELEASE		A Suspected Release	B No Suspected Release	References
Enter Surface Water Likelihood of Release score from page 12.	LR =		500	

HUMAN FOOD CHAIN THREAT TARGETS

8. Record the water body type and flow (if applicable) for each fishery within the target distance limit. If there is no fishery within the target distance limit, assign a Targets score of 0 at the bottom of the page.

Fishery Name	Water Body Type	Flow
Paterison Mill Creek	stream	0 cfs
Chewacla Creek	stream	2.3 cfs
		cfs
		cfs
		cfs

Att 1, 11

9. PRIMARY FISHERIES: If you suspect any fishery listed above has been exposed to a hazardous substance from the site (see Surface Water Criteria List, page 11), assign a score of 300 and do not evaluate Factor 10. List the primary fisheries:

______, ______,
______, ______.

10. SECONDARY FISHERIES

A. If you suspect a release to surface water and have identified a secondary fishery but no primary fishery, assign a score of 210.

B. If you do not suspect a release, assign a Secondary Fisheries score from the table below using the lowest flow at any fishery within the target distance limit.

Lowest Flow	Secondary Fisheries Score
< 10 cfs	210
10 to 100 cfs	30
> 100 cfs, coastal tidal waters, oceans, or Great Lakes	12

Att 1, 11

Secondary Fisheries score (B): 210

T = | A: | B: 210

SURFACE WATER PATHWAY ENVIRONMENTAL THREAT SCORESHEET

Likelihood of Release (LR)

LR is the same for all surface water pathway threats. Enter LR score from page 12.

Environmental Threat Targets (T)

11. PA Table 5 (page 16) lists sensitive environments for the Surface Water Pathway Environmental Threat. In the space provided, identify all sensitive environments located within the target distance limit. Indicate the surface water body type and flow at each sensitive environment. Gauging station flow data for many surface water bodies are available from USGS or other sources. In the absence of gauging station data, estimate flow using the list of surface water body types and associated flow categories in PA Table 4 (page 13). The flow for lakes is determined by the sum of flows of streams entering or leaving the lake. Note that if there are no sensitive environments within the target distance limit, the Environmental Threat Targets score is zero.

12. Primary sensitive environments are surface water sensitive environments within the target distance limit that you suspect have been exposed to a hazardous substance released from the site. Use professional judgment guided by the Surface Water Pathway Criteria List (page 11) to make this determination. If you identify any primary sensitive environments, list them in the space provided, enter 300 as the Primary Sensitive Environments factor score, and do not evaluate Secondary Sensitive Environments. Note that if you do not suspect a release, there can be no primary sensitive environments.

13. Secondary sensitive environments are surface water sensitive environments that you do not suspect have been exposed to a hazardous substance. Evaluate this factor only if surface water sensitive environments are present within the target distance limit, but none is considered a primary sensitive environment. Evaluate secondary sensitive environments based on flow.

- In the table provided, list all secondary sensitive environments on surface water bodies with flow of 100 cfs or less.

    1) Use PA Table 4 (page 13) to determine the appropriate dilution weight for each.

    2) Use PA Tables 5 and 6 (page 16) to determine the appropriate value for each sensitive environment type and for wetlands frontage.

    3) For a sensitive environment that falls into more than one of the categories in PA Table 5, sum the values for each type to determine the environment value (e.g., a wetland with 1.5 miles frontage (value of 50) that is also a critical habitat for a Federally designated endangered species (value of 100) would receive a total value of 150).

    4) For each sensitive environment, multiply the dilution weight by the environment type (or length of wetlands) value and record the product in the far-right column.

    5) Sum the values in the far-right column and enter the total as the Secondary Sensitive Environments score. Do not evaluate part B of this factor.

- If all secondary sensitive environments are on surface water bodies with flows greater than 100 cfs assign 10 as the Secondary Sensitive Environments score.

Sum the target scores in Column A (Suspected Release) or Column B (No Suspected Release).

SURFACE WATER PATHWAY (continued)
ENVIRONMENTAL THREAT SCORESHEET

LIKELIHOOD OF RELEASE		A Suspected Release	B No Suspected Release	References
Enter Surface Water Likelihood of Release score from page 12.	LR =		500	

ENVIRONMENTAL THREAT TARGETS

11. Record the water body type and flow (if applicable) for each surface water sensitive environment within the target distance limit (see PA Tables 4 and 5). If there is no sensitive environment within the target distance limit, assign a Targets score of 0 at the bottom of the page.

Environment Name	Water Body Type	Flow
Paterson Mill Creek	Stream	0 cfs
Chewacla Creek	stream	2.3 cfs
		cfs
		cfs
		cfs

Att 1, 11

12. PRIMARY SENSITIVE ENVIRONMENTS: If you suspect any sensitive environment listed above has been exposed to a hazardous substance from the site (see Surface Water Criteria List, page 11), assign a score of 300 and do not evaluate factor 13. List the primary sensitive environments:

13. SECONDARY SENSITIVE ENVIRONMENTS: If sensitive environments are present, but none is a primary sensitive environment, evaluate Secondary Sensitive Environments based on flow.

A. For secondary sensitive environments on surface water bodies with flows of 100 cfs or less, assign scores as follows, and do not evaluate part B of this factor:

Att 1, 11
12-14
Ref 18

Flow	Dilution Weight (PA Table 4)		Environment Type and Value (PA Tables 5 and 6)		Total
0 cfs	1	x	25 wetland	=	25
2.3 cfs	1	x	25	=	25
0 cfs	1	x	5 clean water	=	5
2.3 cfs	1	x	5	=	5
cfs		x		=	

(see A-3/a)

Sum = 60

B. If all secondary sensitive environments are located on surface water bodies with flows > 100 cfs, assign a score of 10.

T = 60

PA TABLE 5: SURFACE WATER AND AIR PATHWAY SENSITIVE ENVIRONMENTS VALUES

Sensitive Environment	*Assigned Value*
Critical habitat for Federally designated endangered or threatened species Marine Sanctuary National Park Designated Federal Wilderness Area Ecologically important areas identified under the Coastal Zone Wilderness Act Sensitive Areas identified under the National Estuary Program or Near Coastal Water Program of the Clean Water Act Critical Areas identified under the Clean Lakes Program of the Clean Water Act (subareas in lakes or entire small lakes) National Monument (air pathway only) National Seashore Recreation Area National Lakeshore Recreation Area	100
Habitat known to be used by Federally designated or proposed endangered or threatened species National Preserve National or State Wildlife Refuge Unit of Coastal Barrier Resources System Federal land designated for the protection of natural ecosystems Administratively Proposed Federal Wilderness Area Spawning areas critical for the maintenance of fish/shellfish species within a river system, bay, or estuary Migratory pathways and feeding areas critical for the maintenance of anadromous fish species in a river system Terrestrial areas utilized for breeding by large or dense aggregations of vertebrate animals (air pathway) or semi-aquatic foragers (surface water pathway) National river reach designated as Recreational	75
Habitat known to be used by State designated endangered or threatened species Habitat known to be used by a species under review as to its Federal endangered or threatened status Coastal Barrier (partially developed) Federally designated Scenic or Wild River	50
State land designated for wildlife or game management State designated Scenic or Wild River State designated Natural Area Particular areas, relatively small in size, important to maintenance of unique biotic communities	25
State designated areas for protection/maintenance of aquatic life under the Clean Water Act	5
Wetlands	See PA Table 6 (Surface Water Pathway) or PA Table 9 (Air Pathway)

PA TABLE 6: SURFACE WATER PATHWAY WETLANDS FRONTAGE VALUES

Total Length of Wetlands	*Assigned Value*
Less than 0.1 mile	0
0.1 to 1 mile	25
Greater than 1 to 2 miles	50
Greater than 2 to 3 miles	75
Greater than 3 to 4 miles	100
Greater than 4 to 8 miles	150
Greater than 8 to 12 miles	250
Greater than 12 to 16 miles	350
Greater than 16 to 20 miles	450
Greater than 20 miles	500

both creeks

Table 1:	**Aquatic, Federally Endangered or Threatened Species**	
Common Name	**Listing**	**Distribution in Alabama**
Fine-lined Pocketbook Mussel	Threatened	Macon County; Alabama River drainage
Ovate clubshell mussel	Endangered	Macon County; Statewide
Southern clubshell mussel	Endangered	Macon County; Statewide except Mobile Delta/Alabama River drainage

(Att. 12-14; Ref. 18)

Table 4:	**Terrestrial, Federally Endangered or Threatened Species**	
Common Name	**Listing**	**Distribution in Alabama**
Florida Panther	Endangered	Statewide
Red Wolf	Endangered	Statewide
Indiana Bat	Endangered	Lee and Macon Counties
American Peregrine Falcon	Endangered/Critical Habitat	Statewide
Arctic Peregrine Falcon	Threatened	Statewide
Bachman's Warbler	Endangered	Statewide/Probably Extirpated
Bald Eagle	Endangered	Statewide
Eskimo Curlew	Endangered	Statewide
Ivory Billed Woodpecker	Endangered	Extirpated Statewide
Red-cockaded woodpecker	Endangered	Lee County; Statewide
Wood Stork	Endangered	Statewide
American Burying Beetle	Endangered	Statewide
Alabama Canebrake Pitcher Plant	Endangered	Central Alabama
Relict Trillium	Endangered	Lee County

(Att. 12-14; Ref. 18)

SURFACE WATER PATHWAY WASTE CHARACTERISTICS, THREAT, AND PATHWAY SCORES

Waste Characteristics (WC)

14. Waste Characteristics: Score is assigned from page 4. However, if a primary target has been identified for any surface water threat, assign either the score calculated on page 4 or a score of 32, whichever is greater.

Surface Water Pathway Threat Scores

Fill in the matrix with the appropriate scores from the previous pages. To calculate the score for each threat: multiply the scores for LR, T, and WC; divide the product by 82,500; and round the result to the nearest integer. The Drinking Water Threat and Human Food Chain Threat are each subject to a maximum of 100. The Environmental Threat is subject to a maximum of 60. Enter the rounded threat scores in the far-right column.

Surface Water Pathway Score

Sum the individual threat scores to determine the Surface Water Pathway Score. If the sum is greater than 100, assign 100.

SURFACE WATER PATHWAY (concluded)
WASTE CHARACTERISTICS, THREAT, AND PATHWAY SCORE SUMMARY

WASTE CHARACTERISTICS

	A *Suspected Release*	B *No Suspected Release*
14. A. If you have identified any primary target for surface water (pages 12, 14, or 15), assign the waste characteristics score calculated on page 4, or a score of 32, whichever is GREATER; do not evaluate part B of this factor.	(100 or 32)	
B. If you have NOT identified any primary target for surface water, assign the waste characteristics score calculated on page 4.	(100, 32, or 18)	(100, 32, or 18) 32
WC =		32

SURFACE WATER PATHWAY THREAT SCORES

Threat	*Likelihood of Release (LR) Score (from page 12)*	*Targets (T) Score (pages 12, 14, 15)*	*Pathway Waste Characteristics (WC) Score – (determined above)*	*Threat Score LR x T x WC / 82,500*
Drinking Water	500	5	32	(subject to a maximum of 100) 1.0
Human Food Chain	500	210	32	(subject to a maximum of 100) 40.7
Environmental	500	60	32	(subject to a maximum of 60) 11.6

SURFACE WATER PATHWAY SCORE
(Drinking Water Threat + Human Food Chain Threat + Environmental Threat)

(subject to a maximum of 100)
53.3

$$DW = \frac{500 \times 5 \times 32}{82{,}500} = \frac{80{,}000}{82{,}500} = 0.9696 = 1.0$$

$$HFC = \frac{500 \times 210 \times 32}{82{,}500} = \frac{3{,}360{,}000}{82{,}500} = 40.727 = 40.7$$

$$Envir = \frac{500 \times 60 \times 32}{82{,}500} = \frac{960{,}000}{82{,}500} = 11.636 = 11.6$$

SOIL EXPOSURE PATHWAY CRITERIA LIST

Areas of surficial contamination can generally be assumed. This "Criteria List" helps guide the process of developing a hypothesis concerning the exposure of specific targets to a hazardous substance at the site. Use the "Resident Population" section to evaluate site and source conditions that may help identify targets likely to be exposed to a hazardous substance. The check-boxes record your professional judgment. Answers to all of the listed questions may not be available during the PA. Also, the list is not all-inclusive; if other criteria help shape your hypothesis, list them at the bottom of the page or attach an additional page.

Check the boxes to indicate a "yes," "no," or "unknown" answer to each question.

SOIL EXPOSURE PATHWAY CRITERIA LIST

SUSPECTED CONTAMINATION	*RESIDENT POPULATION*
Surficial contamination can generally be assumed.	Yes / No / Unk
	☐ ☒ ☐ Is any residence, school, or daycare facility on or within 200 feet of an area of suspected contamination?
	☐ ☒ ☐ Is any residence, school, or daycare facility located on adjacent land previously owned or leased by the site owner/operator?
	☐ ☒ ☐ Is there a migration route that might spread hazardous substances near residences, schools, or daycare facilities?
	☐ ☐ ☒ Have onsite or adjacent residents or students reported adverse health effects, exclusive of apparent drinking water or air contamination problems?
	☐ ☒ ☐ Does any neighboring property warrant sampling?
	☐ ☐ Other criteria? ______________
	☐ ☒ **RESIDENT POPULATION IDENTIFIED?**

Summarize the rationale for Resident Population (attach an additional page if necessary):

SOIL EXPOSURE PATHWAY SCORESHEET

Pathway Characteristics

Answer the questions at the top of the page. Identify people who may be exposed to a hazardous substance because they work at the facility, or reside or attend school or daycare on or within 200 feet of an area of suspected contamination. If the site is active, estimate the number of full and part-time workers. Note that evaluation of targets is based on current site conditions.

Likelihood of Exposure (LE)

1. **Suspected Contamination:** Areas of surficial contamination are present at most sites, and a score of 550 can generally be assigned as a default measure. Assign zero, which effectively eliminates the pathway from further consideration, only if there is no surficial contamination; reliable analytical data are generally necessary to make this determination.

Resident Population Threat Targets (T)

2. **Resident Population** corresponds to "primary targets" for the migration pathways. Use professional judgment guided by the Soil Exposure Pathway Criteria List (page 18) to determine if there are people living or attending school or daycare on or within 200 feet of areas of suspected contamination. Record the number of people identified as resident population and multiply by 10 to determine the Resident Population factor score.

3. **Resident Individual:** Assign 50 if you have identified a resident population; otherwise, assign zero.

4. **Workers:** Estimate the number of full and part-time workers at this facility and adjacent facilities where contamination is also suspected. Assign a score for the Workers factor from the table.

5. **Terrestrial Sensitive Environments:** In the table provided, list each terrestrial sensitive environment located on an area of suspected contamination. Use PA Table 7 (page 20) to assign a value for each. Sum the values and assign the total as the factor score.

6. **Resources:** A score of 5 can generally be assigned as a default measure. Assign zero only if there is no land resource use on an area of suspected contamination.

Sum the target scores.

Waste Characteristics (WC)

7. Enter the WC score determined on page 4.

Resident Population Threat Score: Multiply the scores for LE, T, and WC. Divide the product by 82,500. Round the result to the nearest integer. If the result is greater than 100, assign 100.

Nearby Population Threat Score: Do not evaluate this threat if you gave a zero score to Likelihood of Exposure. Otherwise, assign a score based on the population within a 1-mile radius (use the same 1-mile radius population you evaluate for air pathway population targets):

Population Within One Mile	Nearby Population Threat Score
< 10,000	1
10,000 to 50,000	2
>50,000	4

population 388
see A-38

Soil Exposure Pathway Score: Sum the Resident Population Threat score and the Nearby Population Threat score, subject to a maximum of 100.

SOIL EXPOSURE PATHWAY SCORESHEET

Pathway Characteristics	
Do any people live on or within 200 ft of areas of suspected contamination?	Yes ___ No X
Do any people attend school or daycare on or within 200 ft of areas of suspected contamination?	Yes ___ No X
Is the facility active? Yes ___ No X If yes, estimate the number of workers: ___	

LIKELIHOOD OF EXPOSURE

	Suspected Contamination	References
1. SUSPECTED CONTAMINATION: Surficial contamination can generally be assumed, and a score of 550 assigned. Assign zero only if the absence of surficial contamination can be confidently demonstrated. LE =	550	Att. 1

RESIDENT POPULATION THREAT TARGETS

2. RESIDENT POPULATION: Determine the number of people occupying residences or attending school or daycare on or within 200 feet of areas of suspected contamination (see Soil Exposure Pathway Criteria List, page 18). ___ people x 10 =	0	Att. 3
3. RESIDENT INDIVIDUAL: If you have identified a resident population (factor 2), assign a score of 50; otherwise, assign a score of 0.	0	
4. WORKERS: Use the following table to assign a score based on the total number of workers at the facility and nearby facilities with suspected contamination:	0	
5. TERRESTRIAL SENSITIVE ENVIRONMENTS: Use PA Table 7 to assign a value for each terrestrial sensitive environment on an area of suspected contamination: Sum =	0	
6. RESOURCES	5	Att 1,3
T =	5	

Number of Workers	Score
0	0
1 to 100	5
101 to 1,000	10
> 1,000	15

Terrestrial Sensitive Environment Type	Value

WASTE CHARACTERISTICS

7. Assign the waste characteristics score calculated on page 4. WC =	32

RESIDENT POPULATION THREAT SCORE: $\frac{LE \times T \times WC}{82,500}$ = **1.07**

$\frac{550 \times 5 \times 32}{82,500} = \frac{88,000}{82,500} =$

NEARBY POPULATION THREAT SCORE: **1.0**

See A-38

SOIL EXPOSURE PATHWAY SCORE:
Resident Population Threat + Nearby Population Threat **2.07**

TABLE 2:	**DATA ON SCHOOL SYSTEMS AND DIRECTION AUBURN SOUTHSIDE WASTEWATER TREATMENT PLANT (ASWWTP)**		
Distance Ring	**School Name**	**Direction from ASWWTP**	**Population of School**
0.0-1.0	None	NA	0
1.0-2.0	Auburn Jr. High School	E	691
	Wrights Mill Elem School	E	540
2.0-3.0	Auburn High School	E	1,182
	Cary Woods Elem. School	N	505
	Dean Road Elem. School	E	497
	Drake Middle School	N	717
3.0-4.0	None	NA	0
Total Number of Schools: 6		Total Population:	4,132

(Att. 1, 15)

Table 3:	**Estimated Population**
Distance From Site	**Population**
0.00-0.25	10
0.25-0.50	25
0.50-1.0	348
1.0-2.0	9,044
2.0-3.0	10,246
3.0-4.0	2,253
Total Population	**21,926**

(Att. 1; Ref. 20)

PA TABLE 7: SOIL EXPOSURE PATHWAY TERRESTRIAL SENSITIVE ENVIRONMENT VALUES

Terrestrial Sensitive Environment	*Assigned Value*
Terrestrial critical habitat for Federally designated endangered or threatened species National Park Designated Federal Wilderness Area National Monument	100
Terrestrial habitat known to be used by Federally designated or proposed threatened or endangered species National Preserve (terrestrial) National or State terrestrial Wildlife Refuge Federal land designated for protection of natural ecosystems Administratively proposed Federal Wilderness Area Terrestrial areas utilized by large or dense aggregations of animals (vertebrate species) for breeding	75
Terrestrial habitat used by State designated endangered or threatened species Terrestrial habitat used by species under review for Federal designated endangered or threatened status	50
State lands designated for wildlife or game management State designated Natural Areas Particular areas, relatively small in size, important to maintenance of unique biotic communities	25

AIR PATHWAY CRITERIA LIST

This "Criteria List" helps guide the process of developing a hypothesis as to whether a release to the air is likely to be detected. The check-boxes record your professional judgment. Answers to all of the listed questions may not be available during the PA. Also, the list is not all-inclusive; if other criteria help shape your hypothesis, list them at the bottom of the page or attach an additional page.

The "Suspected Release" section identifies several conditions that could provide insight as to whether a release from the site is likely to be detected. If a release is suspected, primary targets are any residents, workers, students, and sensitive environments on or within ¼ mile of the site.

Check the boxes to indicate a "yes," "no," or "unknown" answer to each question. If you check the "Suspected Release" box as "yes," make sure you assign a Likelihood of Release value of 550 for the pathway.

AIR PATHWAY CRITERIA LIST

SUSPECTED RELEASE	*PRIMARY TARGETS*
Yes / No / Unk	
☐ ☐ ☐ Are odors currently reported?	
☐ ☐ ☐ Has release of a hazardous substance to the air been directly observed?	If you suspect a release to air, evaluate all populations and sensitive environments within 1/4 mile (including those onsite) as primary targets.
☐ ☐ ☐ Are there reports of adverse health effects (e.g., headaches, nausea, dizziness) potentially resulting from migration of hazardous substances through the air?	
☐ ☐ ☐ Does analytical or circumstantial evidence suggest a release to the air?	
☐ ☐ Other criteria?____________________	
☐ ☐ **SUSPECTED RELEASE?**	

Summarize the rationale for Suspected Release (attach an additional page if necessary):

Not Calculated

AIR PATHWAY SCORESHEET

Pathway Characteristics

Answer the questions at the top of the page. Refer to the Air Pathway Criteria List (page 21) to hypothesize whether you suspect that a hazardous substance release to the air could be detected. Due to dispersion, releases to air are not as persistent as releases to water migration pathways and are much more difficult to detect. Develop your hypothesis concerning the release of hazardous substances to air based on "real time" considerations. Record the distance (in feet) from any source to the nearest regularly occupied building.

Likelihood of Release (LR)

1. **Suspected Release:** Hypothesize based on professional judgment guided by the Air Pathway Criteria List (page 21). If you suspect a release to air, use only Column A for this pathway and do not evaluate factor 2.

2. **No Suspected Release:** If you do not suspect a release, enter 500 and use only Column B for this pathway.

Targets (T)

3. **Primary Target Population:** Evaluate populations subject to exposure from release of a hazardous substance from the site. If you suspect a release, the resident, student, and worker populations on and within ¼ mile of the site are considered primary target population. If only the number of residences is known, use the average county residents per household (rounded up to the next integer) to determine the population. In the space provided, enter this population. Multiply the population by 10 to determine the Primary Target Population score. Note that if you do not suspect a release, there can be no primary target population.

4. **Secondary Target Population:** Evaluate populations in distance categories not suspected to be subject to exposure from release of a hazardous substance from the site. If you suspect a release, residents, students, and workers in the ¼- to 4-mile distance categories are secondary target population. If you do not suspect a release, all residents, students, and workers onsite and within 4 miles are considered secondary target population.

Use PA Table 8 (page 23). Enter the population in each secondary target population distance category, circle the assigned value, and record it on the far-right side of the table. Sum the far-right column and enter the total as the Secondary Target Population factor score.

5. **Nearest Individual** represents the threat posed to the person most likely to be exposed to a hazardous substance release from the site. If you have identified a primary target population, enter 50. Otherwise, assign the score from PA Table 8 (page 23) for the closest distance category in which you have identified a secondary target population.

6. **Primary Sensitive Environments:** If a release is suspected, all sensitive environments on or within ¼ mile of the site are considered primary targets. List them and assign values for sensitive environment type (from PA Table 5, page 16) and/or wetland acreage (from PA Table 9, page 23). Sum the values and enter the total as the factor score.

7. **Secondary Sensitive Environments:** If a release is suspected, sensitive environments in the ¼- to ½-mile distance category are secondary targets; greater distances need not be evaluated because distance weighting greatly diminishes the impact on site score. If you do not suspect a release, all sensitive environments on and within ½ mile of the site are considered secondary targets. List each secondary sensitive environment on PA Table 10 (page 23) and assign a value to each using PA Tables 5 and 9. Multiply each value by the indicated distance weight and record the product in the far-right column. Sum the products and enter the total as the factor score.

8. **Resources:** A score of 5 can generally be assigned as a default measure. Assign zero only if there is no land resource use within ½ mile.

Sum the target scores in Column A (Suspected Release) or Column B (No Suspected Release).

Waste Characteristics (WC)

9. **Waste Characteristics:** Score is assigned from page 4. However, if you have identified any primary target for the air pathway, assign either the score calculated on page 4 or a score of 32, whichever is greater.

Air Pathway Score: Multiply the scores for LR, T, and WC. Divide the product by 82,500. Round the result to the nearest integer. If the result is greater than 100, assign 100.

AIR PATHWAY SCORESHEET

Pathway Characterization	
Do you suspect a release (see Air Pathway Criteria List, page 21)?	Yes ___ No X
Distance to the nearest individual:	______ ft

Not calculated

LIKELIHOOD OF RELEASE

	A Suspected Release	B No Suspected Release	References
1. SUSPECTED RELEASE: If you suspect a release to air (see page 21), assign a score of 550. Use only column A for this pathway.			
2. NO SUSPECTED RELEASE: If you do not suspect a release to air, assign a score of 500. Use only column B for this pathway.			
LR =			

TARGETS

	A	B	References
3. PRIMARY TARGET POPULATION: Determine the number of people subject to exposure from a suspected release of hazardous substances to the air. ______ people x 10 =			
4. SECONDARY TARGET POPULATION: Determine the number of people not suspected to be exposed to a release to air, and assign the total population score using PA Table 8.			
5. NEAREST INDIVIDUAL: If you have identified any Primary Target Population for the air pathway, assign a score of 50; otherwise, assign the Nearest Individual score from PA Table 8.			
6. PRIMARY SENSITIVE ENVIRONMENTS: Sum the sensitive environment values (PA Table 5) and wetland acreage values (PA Table 9) for environments subject to exposure from a suspected release to the air. Sum =			
7. SECONDARY SENSITIVE ENVIRONMENTS: Use PA Table 10 to determine the score for secondary sensitive environments.			
8. RESOURCES			
T =			

Sensitive Environment Type	Value
______	______
______	______

WASTE CHARACTERISTICS

	A	B
9. A. If you have identified any Primary Target for the air pathway, assign the waste characteristics score calculated on page 4, or a score of 32, whichever is GREATER; do not evaluate part B of this factor.		
B. If you have NOT identified any Primary Target for the air pathway, assign the waste characteristics score calculated on page 4.		
WC =		

AIR PATHWAY SCORE: $\frac{LR \times T \times WC}{82{,}500}$ = ______

PA TABLE 8: VALUES FOR SECONDARY AIR TARGET POPULATIONS

Distance from Site	Population	Nearest Individual (choose highest)	Population Within Distance Category												Population Value
			1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	Greater than 1,000,000	
Onsite	______	20	1	2	5	16	52	163	521	1,633	5,214	16,325	52,136	163,246	______
>0 to ¼ mile	______	20	1	1	1	4	13	41	130	408	1,303	4,081	13,034	40,811	______
>¼ to ½ mile	______	2	0	0	1	1	3	9	28	88	282	882	2,815	8,815	______
>½ to 1 mile	______	1	0	0	0	1	1	3	8	26	83	261	834	2,612	______
>1 to 2 miles	______	0	0	0	0	0	1	1	3	8	27	83	266	833	______
>2 to 3 miles	______	0	0	0	0	0	1	1	1	4	12	38	120	376	______
>3 to 4 miles	______	0	0	0	0	0	0	1	1	2	7	23	73	229	______

Nearest Individual = ______   Score = ______

PA TABLE 9: AIR PATHWAY VALUES FOR WETLAND AREA

Wetland Area	Assigned Value
Less than 1 acre	0
1 to 50 acres	25
Greater than 50 to 100 acres	75
Greater than 100 to 150 acres	125
Greater than 150 to 200 acres	175
Greater than 200 to 300 acres	250
Greater than 300 to 400 acres	350
Greater than 400 to 500 acres	450
Greater than 500 acres	500

PA TABLE 10: DISTANCE WEIGHTS AND CALCULATIONS FOR AIR PATHWAY SECONDARY SENSITIVE ENVIRONMENTS

Distance	Distance Weight	Sensitive Environment Type and Value (from PA Table 5 or 9)	Product
Onsite	0.10	x	
		x	
0-1/4 mi	0.025	x	
		x	
		x	
1/4-1/2 mi	0.0054	x	
		x	
		x	
		x	

Total Environments Score = ______

SITE SCORE CALCULATION

In the column labeled S, record the Ground Water Pathway score, the Surface Water Pathway score, the Soil Exposure Pathway score, and the Air Pathway score. Square each pathway score and record the result in the S^2 column. Sum the squared pathway scores. Divide the sum by 4, and take the square root of the result to obtain the Site Score.

SUMMARY

Answer the summary questions, which ask for a qualitative evaluation of the relative risk of targets being exposed to a hazardous substance from the site. You may find your responses to these questions a good cross-check against the way you scored the individual pathways. For example, if you scored the ground water pathway on the basis of no suspected release and secondary targets only, yet your response to question #1 is "yes," this presents apparently conflicting conclusions that you need to reconsider and resolve. Your answers to the questions on page 24 should be consistent with your evaluations elsewhere in the PA scoresheets package.

SITE SCORE CALCULATION

	S	S^2
GROUND WATER PATHWAY SCORE (S_{gw}):	1.0	1.00
SURFACE WATER PATHWAY SCORE (S_{sw}):	53.3	2,840.89
SOIL EXPOSURE PATHWAY SCORE (S_s):	2.07	4.2849
AIR PATHWAY SCORE (S_a):	not calculated	
SITE SCORE: $\sqrt{\frac{2,846.1749}{4}} = \sqrt{711.5437725}$ $\sqrt{\frac{S_{gw}^2+S_{sw}^2+S_s^2+S_a^2}{4}} = 26.67$		26.67

SUMMARY

	YES	NO
1. Is there a high possibility of a threat to any nearby drinking water well(s) by migration of a hazardous substance in ground water?	☐	☒
A. If yes, identify the well(s). ______		
B. If yes, how many people are served by the threatened well(s)? ______		
2. Is there a high possibility of a threat to any of the following by hazardous substance migration in surface water?		
A. Drinking water intake	☐	☒
B. Fishery	☐	☒
C. Sensitive environment (wetland, critical habitat, others)	☐	☒
D. If yes, identify the target(s). ______		
3. Is there a high possibility of an area of surficial contamination within 200 feet of any residence, school, or daycare facility?	☐	☒
If yes, identify the property(ies) and estimate the associated population(s). ______		
4. Are there public health concerns at this site that are not addressed by PA scoring considerations? If yes, explain: ______	☐	☒

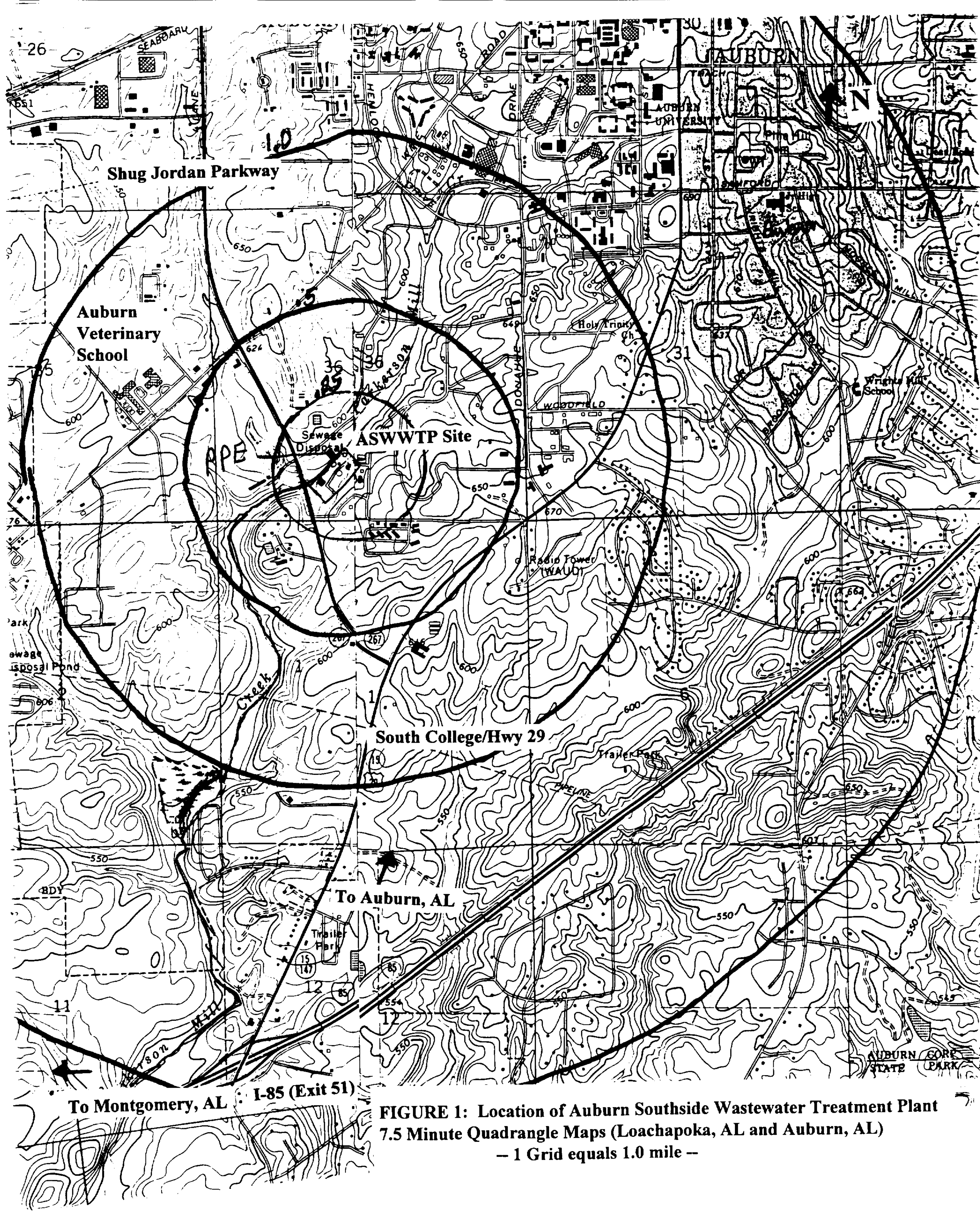

FIGURE 1: Location of Auburn Southside Wastewater Treatment Plant
7.5 Minute Quadrangle Maps (Loachapoka, AL and Auburn, AL)
– 1 Grid equals 1.0 mile –

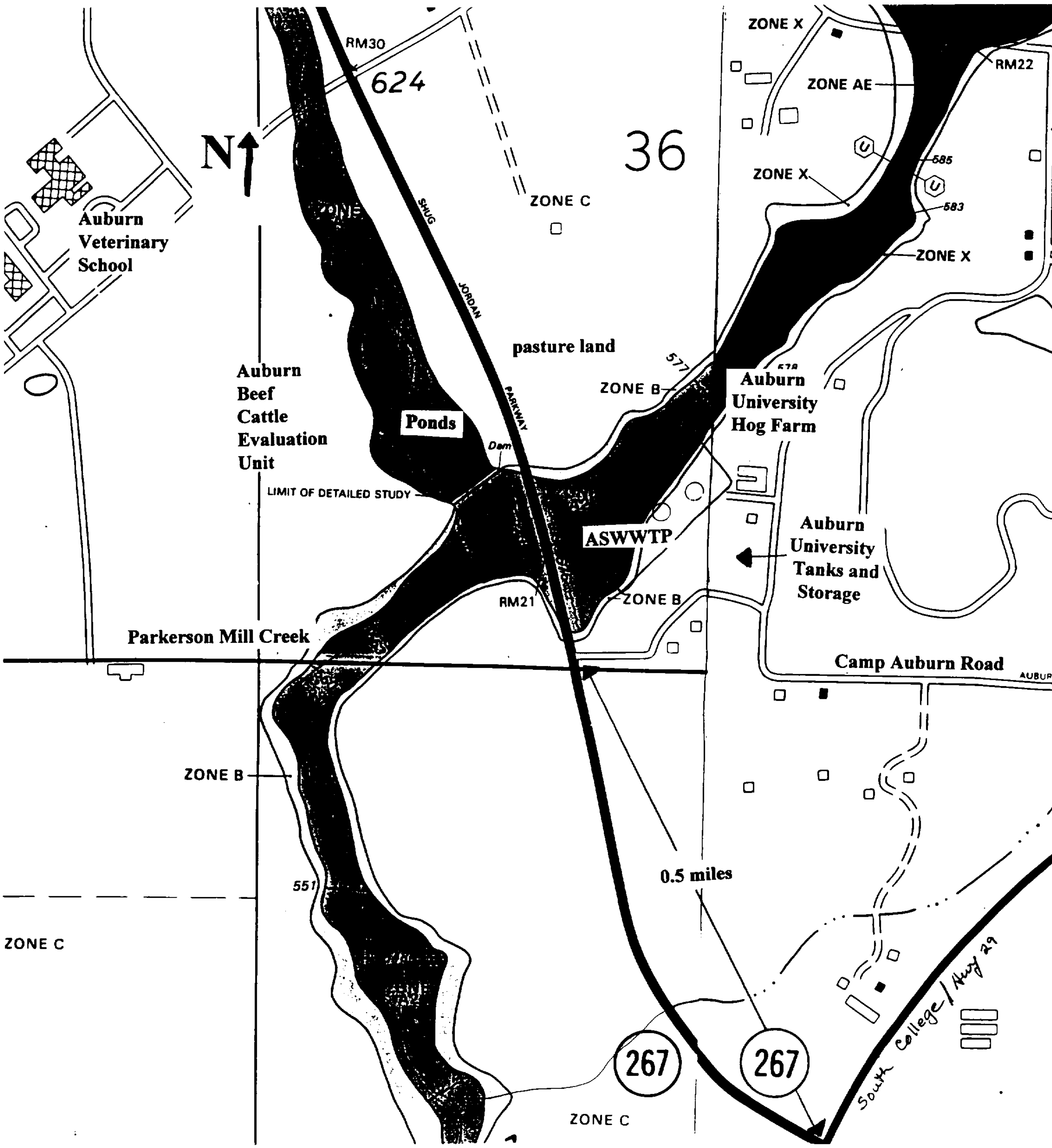

FIGURE 2: ASWWTP and Vicinity Site Sketch
City of Auburn: Comm. Panel 010144-0059D
-- Not To Scale --

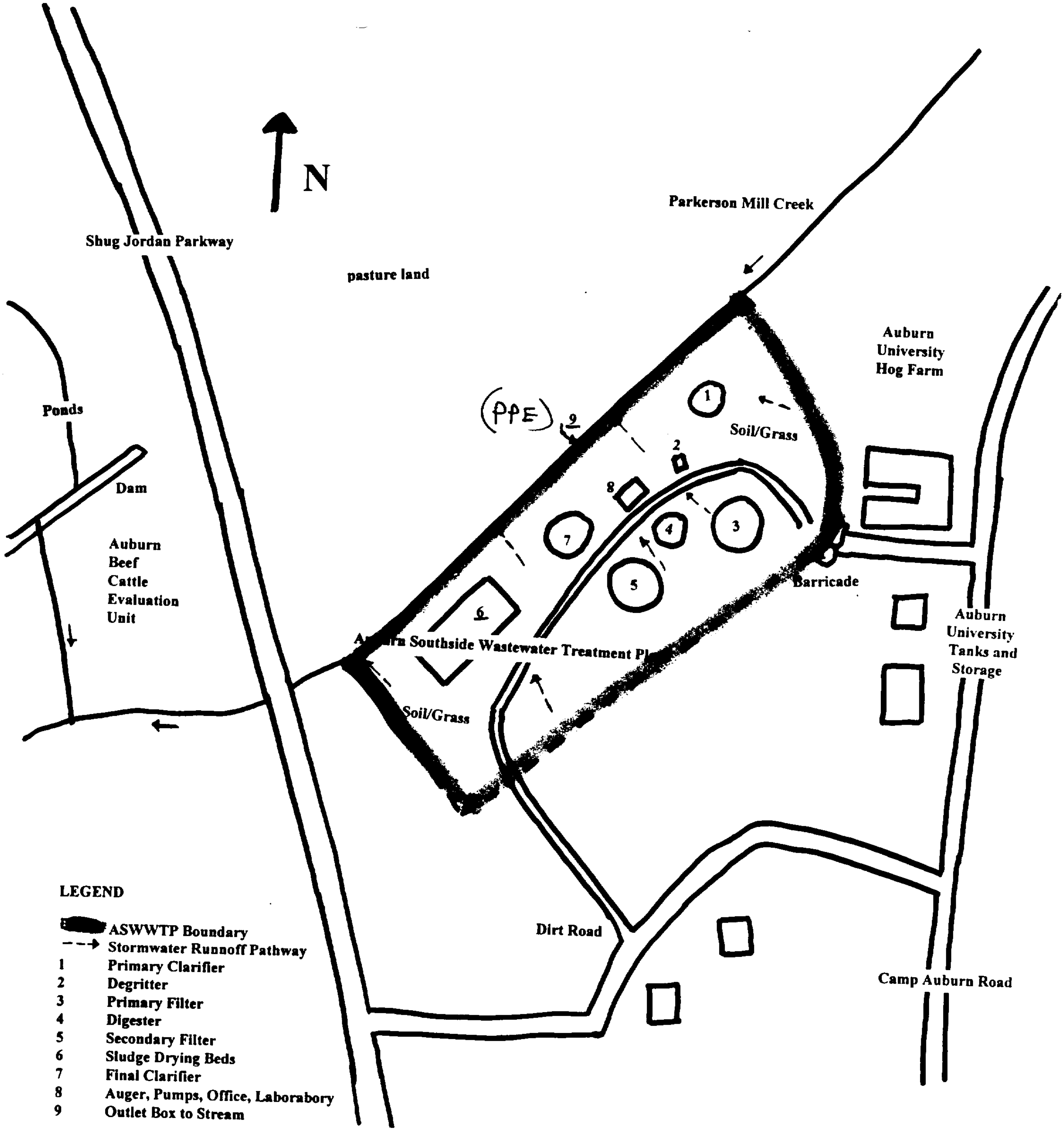

FIGURE 3: Auburn Southside Wastewater Treatment Plant
Site Sketch Showing Estimated Location of Structures
-- Not To Scale --

Table 1:	**Aquatic, Federally Endangered or Threatened Species**	
Common Name	**Listing**	**Distribution in Alabama**
Fine-lined Pocketbook Mussel	Threatened	Macon County; Alabama River drainage
Ovate clubshell mussel	Endangered	Macon County; Statewide
Southern clubshell mussel	Endangered	Macon County; Statewide except Mobile Delta/Alabama River drainage

(Att. 12-14; Ref. 18)

TABLE 2:	DATA ON SCHOOL SYSTEMS AND DIRECTION AUBURN SOUTHSIDE WASTEWATER TREATMENT PLANT (ASWWTP)		
Distance Ring	**School Name**	**Direction from ASWWTP**	**Population of School**
0.0-1.0	None	NA	0
1.0-2.0	Auburn Jr. High School Wrights Mill Elem School	E E	691 540
2.0-3.0	Auburn High School Cary Woods Elem. School Dean Road Elem. School Drake Middle School	E N E N	1,182 505 497 717
3.0-4.0	None	NA	0
Total Number of Schools: 6		Total Population:	4,132

(Att. 1, 15)

Table 3:	Estimated Population
Distance From Site	**Population**
0.00-0.25	10
0.25-0.50	25
0.50-1.0	348
1.0-2.0	9,044
2.0-3.0	10,246
3.0-4.0	2,253
Total Population	**21,926**

(Att. 1; Ref. 20)

Table 4:	**Terrestrial, Federally Endangered or Threatened Species**	
Common Name	**Listing**	**Distribution in Alabama**
Florida Panther	Endangered	Statewide
Red Wolf	Endangered	Statewide
Indiana Bat	Endangered	Lee and Macon Counties
American Peregrine Falcon	Endangered/Critical Habitat	Statewide
Arctic Peregrine Falcon	Threatened	Statewide
Bachman's Warbler	Endangered	Statewide/Probably Extirpated
Bald Eagle	Endangered	Statewide
Eskimo Curlew	Endangered	Statewide
Ivory Billed Woodpecker	Endangered	Extirpated Statewide
Red-cockaded woodpecker	Endangered	Lee County; Statewide
Wood Stork	Endangered	Statewide
American Burying Beetle	Endangered	Statewide
Alabama Canebrake Pitcher Plant	Endangered	Central Alabama
Relict Trillium	Endangered	Lee County

(Att. 12-14; Ref. 18)

7. ATTACHMENTS

1. U.S.G.S. 7.5 Minute Series Topographic Quadrangle Maps of Alabama: Auburn, Alabama, 1971 (Photorevised 1983); Little Texas, Alabama, 1971; Loachapoka, Alabama, 1971 (Photorevised 1983); Opelika West, Alabama, 1971 (Photorevised 1983); Society Hill, Alabama, 1971 (Photorevised 1985); Waverly, Alabama, 1971. Scale 1:24,000.

2. Lovoy, David M., ADEM, Water Division, Preliminary Assessment - Groundwater, Auburn Wastewater Treatment Facility, Alabama, AL0001409192, Ref. No. 6477, August 13, 1996.

3. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Trip Report for Auburn Southside WWTP, Auburn, Alabama, AL0001409192, Ref. No. 6477, Trip date: December 9, 1996.

4. Temple, Bonnie L. and Jerremy H. Stamps, ADEM, Land Division, Hazardous Waste Branch, Photo-documentation Log for Auburn Southside Wastewater Treatment Plant, Alabama, AL0001409192, Ref. No. 6477, Trip dates: April 5, 1994 and December 9, 1996.

5. Converse, J. B. & Co., Inc., Engineers, Blueprints entitled: "Site Grading & Drainage" and "Secondary Filter" for City of Auburn, Alabama, South Side Sewage Treatment Plant, February 1958 and February 1958/December 12, 1960.

6. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Personal Communication with City of Auburn, Auburn, Alabama, December 18, 1996 through January 15, 1997.

7. ADEM, Land Division, Hazardous Waste Branch (Special Project's files), Auburn Southside WWTP, Auburn, Alabama, AL0001409192, Ref. No. 6477, March 15, 1994 through April 22, 1994.

8. Weston, Roy F., Inc., "Contaminated Soil Management Plant, Southside Waste Treatment Facility, Auburn, Alabama 36830," Work Order No. 02871-005-001-0002-05, August, 24, 1994.

9. Steel, Ernest W., Water Supply and Sewage, Fourth Edition, McGraw-Hill Book Company, Inc., New York, 1960.

10. Federal Emergency Management Agency, Flood Insurance Rate Maps, City of Auburn, Alabama, Lee County, Community Panel Numbers Map Index and 0101440059, Effective dates: May 17, 1993 and September 16, 1981, respectively.

11. Hayes, Eugene C., Geological Survey of Alabama, 1978, 7-Day Low Flows and Flow Duration of Alabama Streams Through 1973. Geological Survey of Alabama Bulletin 113.

12. U.S. Fish and Wildlife Service, "Endangered Species By County List," April 1994.

13. State of Alabama, Department of Conservation and Natural Resources, "Alabama Federally Listed Endangered/Threatened Species," October 16, 1991.

ATTACHMENTS CONTINUED (Page 2)

14. U.S. Fish and Wildlife Service, Endangered and Threatened Species of the Southeast United States (The Red Book). Prepared by Ecological Services, Division of Endangered Species, Southeast Region. Government Printing Office, Washington, D. C. (two volumes), 1992.

15. Temple, Bonnie L., ADEM, Land Division, Hazardous Waste Branch, Telephone Conversation with Auburn City Schools, December 16, 1996.

OVERSIZED

DOCUMENT

ADEM
ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

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AUG 1996
ADEM
SPECIAL PROJECTS

August 13, 1996

MEMORANDUM

TO: Dan Cooper, Chief
Special Projects

FROM: David M. Lovoy, Hydrogeolgist DML
Groundwater Branch
Water Division

RE: Preliminary Assessment - Groundwater
Auburn Wastewater Treatment Facility
Auburn, Lee County, Alabama

The following CERCLA Preliminary Groundwater Assessment was conducted through a search of the literature and information available to the Department. No site inspection was conducted by the author.

LOCATION

The Auburn Wastewater Treatment Facility (AWTF Site) is located in Lee County just southwest of the main part of the city of Auburn. The U.S. Geological Survey's 7.5 Minute Quadrangle Map entitled Auburn, Ala., gives the location of the AWTF Site in the southwest 1/4 of Section 36, Township 18 North, Range 25 East (Figure 2). The latitude and longitude for the site has been estimated to be 32° 35' 19" North and 85° 30' 06" West respectively.

TOPOGRAPHY AND SURFACE WATER

The AWTF Site is within the Southern Piedmont Upland physiographic section. This section has rolling topography indicative of a dissected peneplain of advanced erosional maturity. Altitudes vary from about 500 to 900 feet above sea level. Surface elevations at the site are estimated to be 580 to 630 feet above mean sea level (MSL) and the slope is approximately 6 to 10 percent to the southeast and south.

Surface water drainage is to the south towards Parkerson Mill Creek which is listed in ADEM Admin. Code R. 335-6-11-.02 with a use classification of fish

ATTACHMENT 2

and wildlife from Chewacla Creek to its source. Chewacla Creek has a use classification of fish and wildlife from Uphapee Creek to Chewacla State Park.

SOILS

Soils at the AWTF Site have been classified by the Soil Conservation Service as Pacolet sandy loam, 6 to 10 percent slopes. They are moderately deep, well drained soils that have developed on narrow ridgetops and side slopes of the Piedmont Plateau.

The typical soil sequence consists of 3 inches of reddish brown sandy loam. The subsoil is yellowish red sandy clay loam to a depth of 7 inches, red clay to a depth of 26 inches, and red clay loam to a depth of 34 inches. The underlying material is mottled yellow, brown, and red soft saprolite. The soil is strongly acid or very strongly acid and the natural fertility is low. The permeability is moderate and the potential for erosion is moderate to severe if cultivated crops are grown. (McNutt, 1981).

GEOLOGY

Lee County is underlain by metamorphic and igneous rocks that range in age from Precambrian to Triassic. These rocks are overlain by sedimentary sand, gravel, and clay of Cretaceous age in the southern part of the county, and by alluvial deposits of Pleistocene and Holocene age in and adjacent to stream valleys (Scott & Lines, 1972).

> Outcropping metamorphic and igneous rocks trend northeastward through the county. Foliation planes of metamorphic rocks dip southeastward in the southern part of the county and northwestward in the northern part. The rocks consist mainly of quartzite, marble, mylonite, amphibolite, granite, and several varieties of gneiss and schist. The rocks are deeply weathered and, as a result, a weathered mantle of saprolite (unconsolidated material and soil) has developed through the decomposition and weathering of underlying bedrock. Saprolite generally is thicker in valleys and draws than on hilltops. The thickest saprolite in the county is associated with quartzite, marble, schist, and gneiss in the central part o f the county (Scott & Lines, 1972).

The AWTF Site is located near the contact of the Manchester Schist. This area is considered to be part of the Pine Mountain Block of the Southern Piedmont lithotectonic province and is described by Raymond, et al, as follows:

The Pine Mountain block is bounded on the north by the northwest edge of the Towaliga fault zone and on the south by the Bartletts Ferry fault of the Goat Rock fault zone (Figure). The block includes the cataclastic rocks of the Towaliga fault zone on the northwest. an older basement schist and gneiss complex (Wacoochee Complex), and a younger metasedimentary sequence of quartzite, marble, and aluminous schist (Pine Mountain Group).

The Towaliga fault zone is a 4.5 to 6.0-mile-wide zone of cataclastic rock along the northwest side of the Pine Mountain block and represents, in part, the sheared limbs of overturned nappes. Rocks within the fault zone include mylonite, blastomylonite, mylonite gneiss, mylonite schist, mylonite quartzite, microbreccia, and scattered tectonic slices of the quartzite-marble-schist sequence of the Pine Mountain Group. The main movement zone of the Towaliga fault bounds a large slice of Pine Mountain rock (Manchester schist) whereas with the Towaliga fault zone are thin, isolated fragments of nappe limbs composed of Pine Mountain rock. Units within the fault zone generally dip steeply northwest but locally the dip is vertical or steep to the southeast. Minor folds within the fault zone suggest a late folding episode subsequent to major tectonic movement.

Southeast of the Towaliga fault zone is the Pine Mountain block proper. Basement rocks of the Pine Mountain block consist of three poorly exposed highly deformed units of feldspathic schist and gneiss of the Wacoochee Complex: the Halawaka Schist, the Whatley Mill Gneiss, and the Phelps Creek Gneiss. The Halawaka Schist and the Whatley Mill Gneiss are highly deformed and appear to represent original basement rock. The Phelps Creek Gneiss appears to have intruded the Halawaka contemporaneously with latter stages of deformation but prior to deposition of the overlying Pine Mountain metasedimentary sequence. Much of the gneiss has feldspar augen as much as 10 inches in diameter. Pegmatites and granitic dikes are common. Radiometric age dates of gneiss in the Pine Mountain block in Georgia indicate a 1.1 billion years old basement.

The overlying younger metasedimentary sequence, the Pine Mountain Group, consists of: the Hollis Quartzite, Chewacla Marble, and Manchester Schist. The Hollis

Quartzite is composed mostly of well-sorted quartz and contains minor amounts of muscovite, microcline, and sulfide minerals. The Chewacla Marble is fine- to coarse-grained light-gray dolomitic marble typically containing flow folds. Overlying the marble is the Manchester Schist, which is composed of a lower graphitic aluminous schist and biotite schist unit, a middle quartzite unit similar to the Hollis Quartzite, and an upper unit of biotite-muscovite-quartz schist and feldspathic schist. Locally, the entire sequence has been injected with granite dikes and pegmatites.

HYDROGEOLOGY

Most of the east-central section of the state is underlain by igneous and metamorphic rocks whose age, structure and stratigraphic relations are not well understood. Within this area lies several major faults, lines of metamorphic discontinuities and structural discontinuities resulting from the movement of one metamorphic rock over another. These rocks are made up of clastic sediments that have been altered by several stages of regional metamorphism to slate, schist, phyllite, quartzite, gneiss and marble (Kidd, 1989).

Recharge areas for the aquifers in Lee County are the same as the outcrop area for the various igneous and metamorphic rocks. Because of the small yields of wells completed in these rocks, none of them are considered major aquifers. Movement of groundwater within the aquifers is controlled by topography, thickness of the saprolite and the size, number and pattern of the fractures in the crystalline bedrock. The direction of groundwater movement is primarily controlled by topography i.e. from uplands to lowlands. Rainfall infiltrates the saprolite, which slowly recharges the fractures in the underlying bedrock. The amount and rate of recharge is dependent upon the thickness and nature of the saprolite (Kidd, 1989).

According to Kidd, 1989,

> Fractures in rock generally decrease in size and in number with depth, and interconnecting fractures rarely occur at depths greater than 200 feet. The fractures in the bedrock of the aquifer may be joints, openings along planes of schistocity, or other openings such as fault planes or fault zones. The dip of the schistocity controls the direction of seepage and the degree and depth of weathering. Most fractures in the study area are steeply dipping to vertical and generally have definite alignments. The fractures in bedrock, enlarged by weathering and solution, are probably

the avenues along which the greatest amounts of groundwater move in aquifers.

The igneous and metamorphic aquifer is susceptible to contamination throughout its outcrop area. This susceptibility is lessened by the thickness of the soils and saprolite. Valleys and lowlands where the water table is near the surface have an increased susceptibility. Major fault zones are highly susceptible to contamination due to their highly transmissive nature and may be areas of increased recharge (Kidd, 1989).

Rocks of the igneous and metamorphic aquifer generally yield less than 25 gallons per minute to wells and as such are not extensively used for public water supply, industry or irrigation. The towns of Auburn and Opelika use surface water as their principle source of water. According, to Kidd, 1989, there are no public water supply wells within 4 miles of the AWTF Site. One well, located near Chewacla State Park was formerly used as a public supply well for the city of Auburn. This well is not currently being used for public water supplies.

Private water supply wells were present within 4 miles of the subject site during the survey conducted as part the construction of the Geological Survey of Alabama Map 131 and accompanying publication. While this publication was printed in 1972, private water supply wells are expected to still be in use within 4 miles of the AWTF Site.

Shallow groundwater at the AWTF Site is expected to move in the direction of the local surface water i.e. to the southeast to south. Deeper groundwater within the bedrock may be more difficult to predict without additional information but should generally move to the south.

Due to the limited amount of water that is obtainable from individual wells in the area, the majority of water used for public supplies is obtained from surface sources. It was estimated in 1985, that approximately 0.88 million gallons per day of groundwater was used in Lee County for public water supply. This is primarily from private water supply wells. Some of these private wells may be present within 4 miles of the AWTF Site.

CLIMATE

The annual precipitation for Lee County is 58 inches. The average temperature in winter is 45° F and the average summer temperature is 77° F (McNutt, 1981).

REFERENCES

Kidd, Robert E., 1989, Geohydrology and Susceptibility of Aquifers to Surface Contamination in Alabama: Area 5; U.S. Geological Survey Water Resources Investigations Report 88-4083.

McNutt, 1981, Soils Survey of Lee County, Alabama; United States Department of Agriculture, Soil Conservation Service.

Raymond, Dorothy E., Edward W. Osborne, Charles W. Copeland, and Thornton L. Neathery, 1988, Circular - Alabama Stratigraphy; Geological Survey of Alabama

Scott, John C., and Gregory C. Lines, 1972, Map 131 - Water Availability , Lee County, Alabama; Geological Survey of Alabama.

Cc: Jymalyn Redmond - Special Projects
Tad Moss - Special Projects

File - Lee County, General

GROUNDWATER ROUTE WORKSHEET REQUIREMENTS

ROUTE CHARACTERISTICS

Aquifer of Concern:	Igneous & Metamorphic aquifer
Depth to aquifer:	0 to 25 feet
Gross Precipitation:	58 inches per year
Net Precipitation:	6 (from HRS)
Slope:	6 to 10 percent
Permeability of Unsaturated Zone:	4×10^{-4} to 1.4×10^{-3}
Is Site Susceptible to Karst:	No

TARGETS

Groundwater Use - There are no active public water supply wells within a 4 mile radius of the subject site. Private water supply wells are expected to be present within 4 miles.

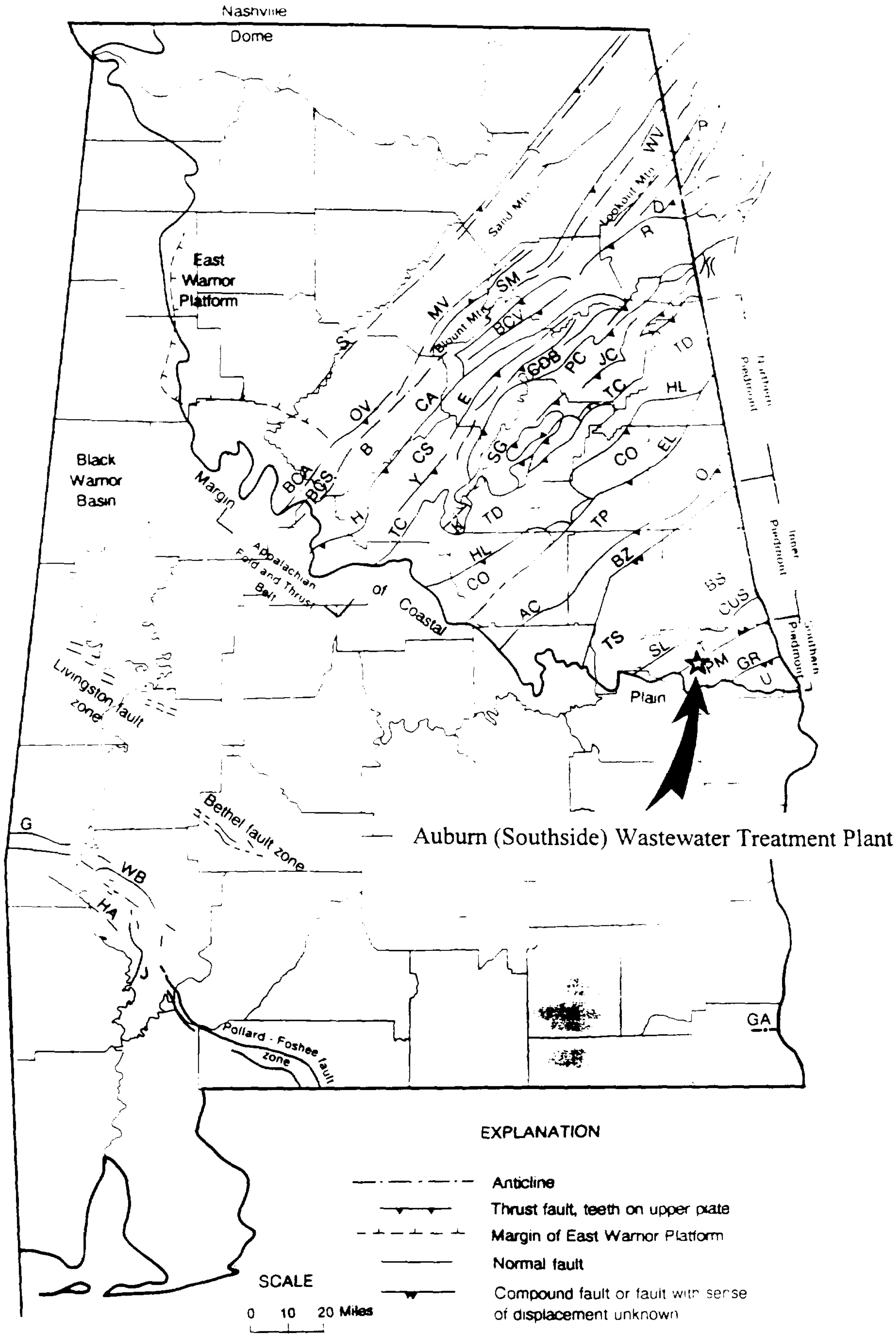

Figure 3--Generalized structural geology map of Alabama (modified from Szabo and others, 1988; Thomas and Neathery, 1982; and Wilson and Tew, 1985). Explanation of symbols is given on facing page.

EXPLANATION

AC	Alexander City fault
B	Birmingham anticlinorium
BCA	Blue Creek anticline
BCS	Blue Creek syncline
BCV	Big Canoe Valley fault
BS	Boyds Creek synform
BZ	Brevard fault zone (includes Abanda and Katy Creek faults)
CA	Cahaba synclinorium
CDB	Coosa deformed belt
CO	Coosa block
CS	Coosa synclinorium
CUS	Cusseta synform
D	Dirtseller Mountain syncline
E	Eden fault
EL	Enitachopco line fault system
G	Gilbertown fault zone
GA	Gordon anticline
GR	Goat Rock fault zone
H	Helena fault
HA	Hatchetigbee anticline
HL	Hollins Line fault
J	Jackson fault
JC	Jacksonville fault complex
K	Kelley Mountain anticline
MV	Murphrees Valley anticline
O	Omaha fault
OV	Opossum Valley fault
P	Peavine anticline
PC	Pell City fault
PM	Pine Mountain block
R	Rome fault
S	Sequatchie anticline
SG	Sleeping Giants klippe
SL	Stonewall line
SM	Straight Mountain fault
T	Towaliga fault zone
TD	Talladega block.
TF	Talladega-Cartersville fault
TP	Tallapoosa block
TS	Tallassee synform
U	Uchee block
WB	West Bend fault zone
WV	Wills Valley anticline
Y	Yellowleaf fault

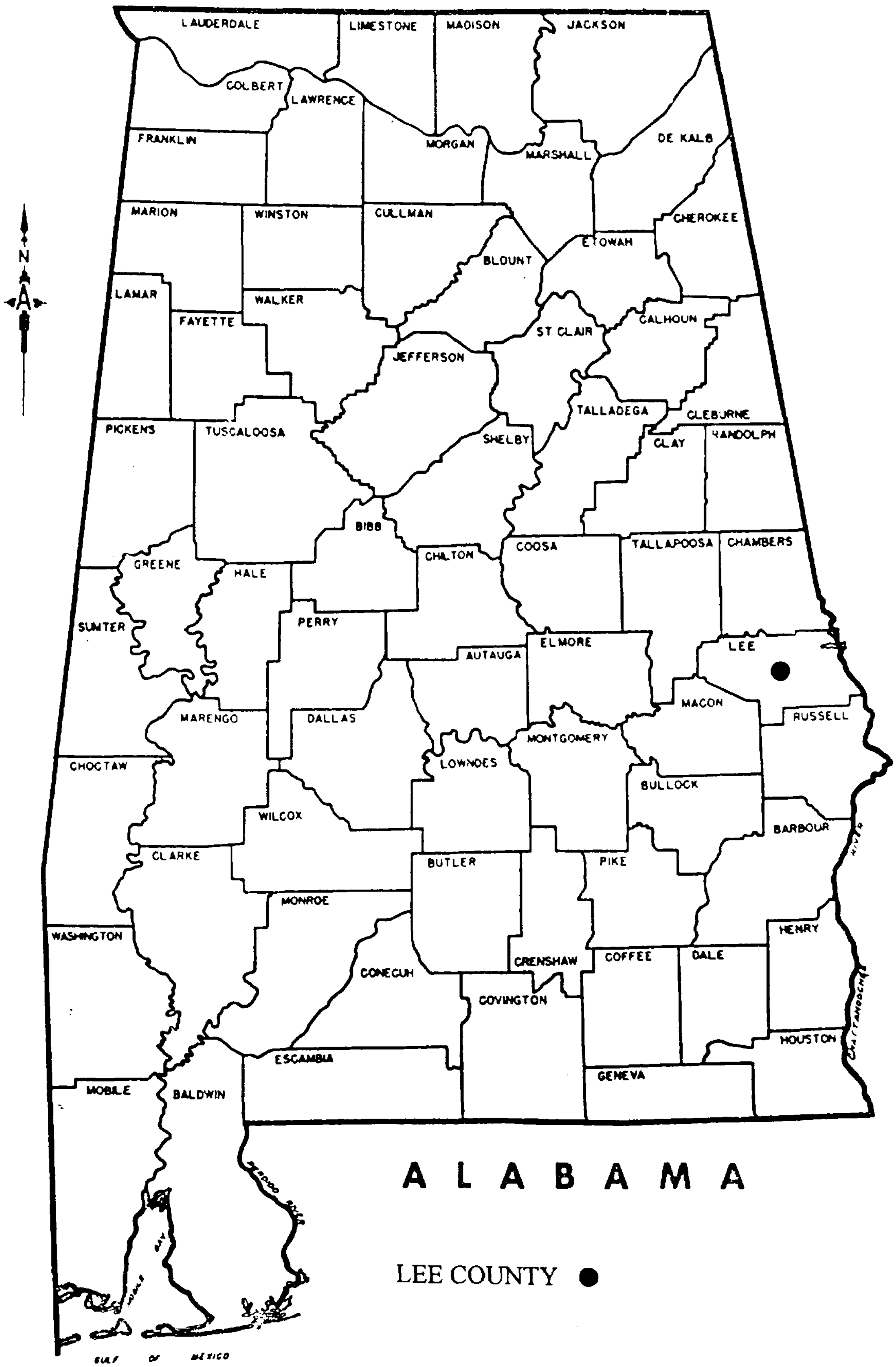
LAUDERDALE
LIMESTONE
MADISON
JACKSON
COLBERT
LAWRENCE
FRANKLIN
MORGAN
MARSHALL
DE KALB
MARION
WINSTON
CULLMAN
BLOUNT
ETOWAH
CHEROKEE
LAMAR
FAYETTE
WALKER
ST. CLAIR
CALHOUN
JEFFERSON
TALLADEGA
CLEBURNE
PICKENS
TUSCALOOSA
SHELBY
CLAY
RANDOLPH
BIBB
GREENE
HALE
CHILTON
COOSA
TALLAPOOSA
CHAMBERS
SUMTER
PERRY
AUTAUGA
ELMORE
LEE
MACON
RUSSELL
MARENGO
DALLAS
MONTGOMERY
LOWNDES
CHOCTAW
BULLOCK
WILCOX
BARBOUR
CLARKE
BUTLER
PIKE
MONROE
WASHINGTON
HENRY
CONECUH
CRENSHAW
COFFEE
DALE
COVINGTON
HOUSTON
ESCAMBIA
GENEVA
MOBILE
BALDWIN
N
A
ALABAMA
LEE COUNTY

Figure 1

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December 10, 1996

To: Jymalyn E. Redmond, Chief
Site Assessment Unit
Hazardous Waste Branch
Land Division

From: Bonnie L. Temple, ES1
Site Assessment Unit
Hazardous Waste Branch
Land Division

BLT

Subject: Trip Report: Auburn Southside WWTP 6477
Shug Jordan Parkway
Auburn, Lee County, AL

On December 9, 1996, Kathleen (Tad) Moss and I travelled to the abandoned Auburn Southside Wastewater Treatment Plant (ASWWTP) in Auburn to conduct an onsite reconnaissance of the site. The inactive facility lies to the east of Shug Jordan Parkway at 0.5 miles north of the junction with South College/Hwy 29 (see attached maps). Two rolls of photographs were taken.

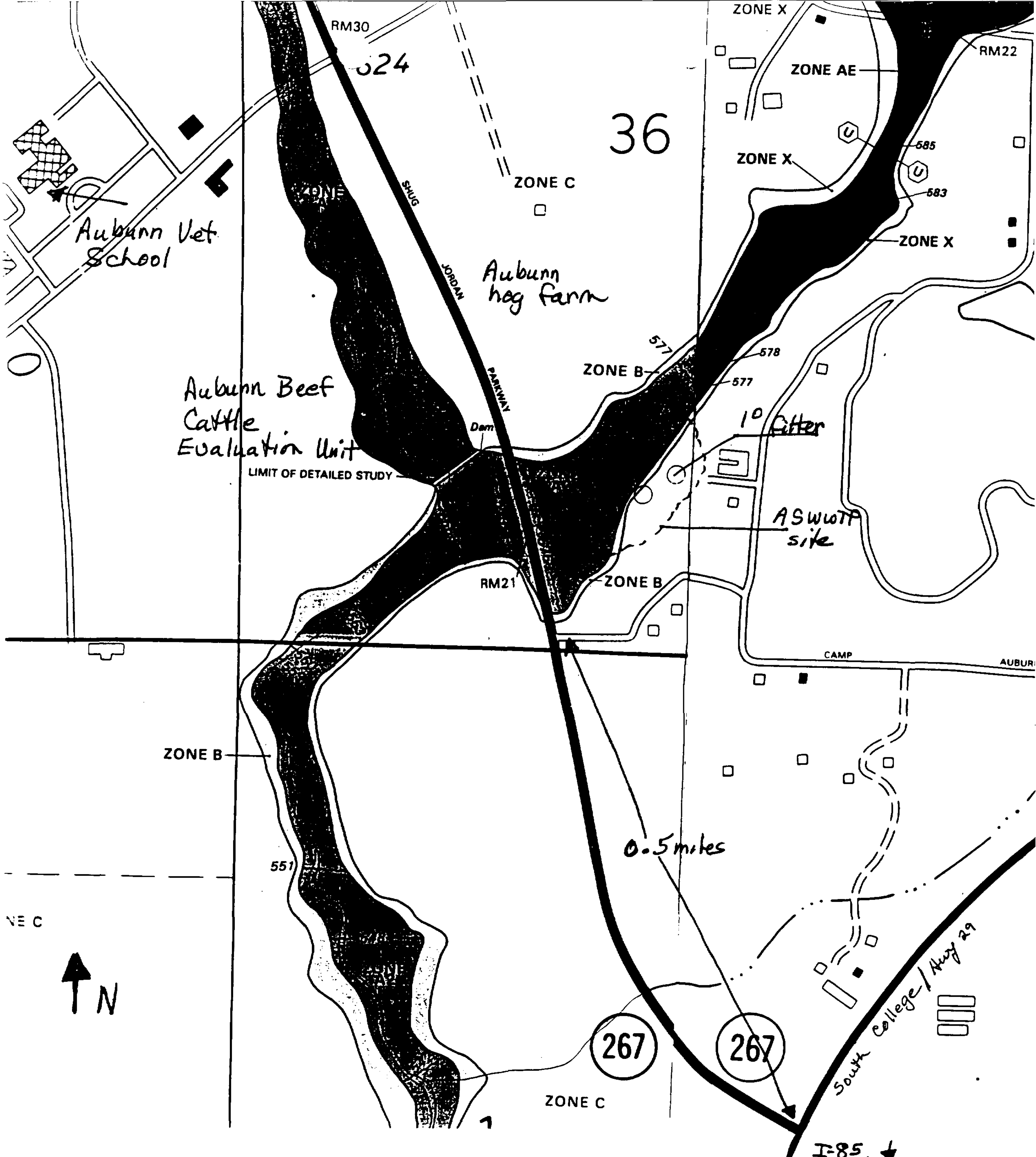
While onsite we observed the primary filter, digester, miscellaneous pipe works, and pathway to stream. The primary filter wall had been broken and approximately 40% of the stone bed with its brick bedliner blocks had been removed. The concrete floor appeared intact. There was no visible water in the primary filter, but water had collected in the rings of the cental sewage column. Mercury beads which had seeped out of the metal column were visible. A break in the wall of the digester allowed visibility of water which had collected in the digester's interior. The outlet box which funnelled the final discharge from the sewage treatment plant into Parkerson Mill Creek was located on the stream bank. The discharge pipe was partially blocked by excess soil, but the discharge pathway is distinct. Parkerson Mill Creek water was flowing at the time of site visit and appears perennial. A rabbit and deer tracks were viewed while onsite. The clarifiers were not evident.

Auburn University's hog farm lies to the north across Parkerson Mill Creek, and Auburn's Beef Cattle Evaluation Unit lies to the west across Shug Jordan Parkway. No residences were noted in the area.

BLT

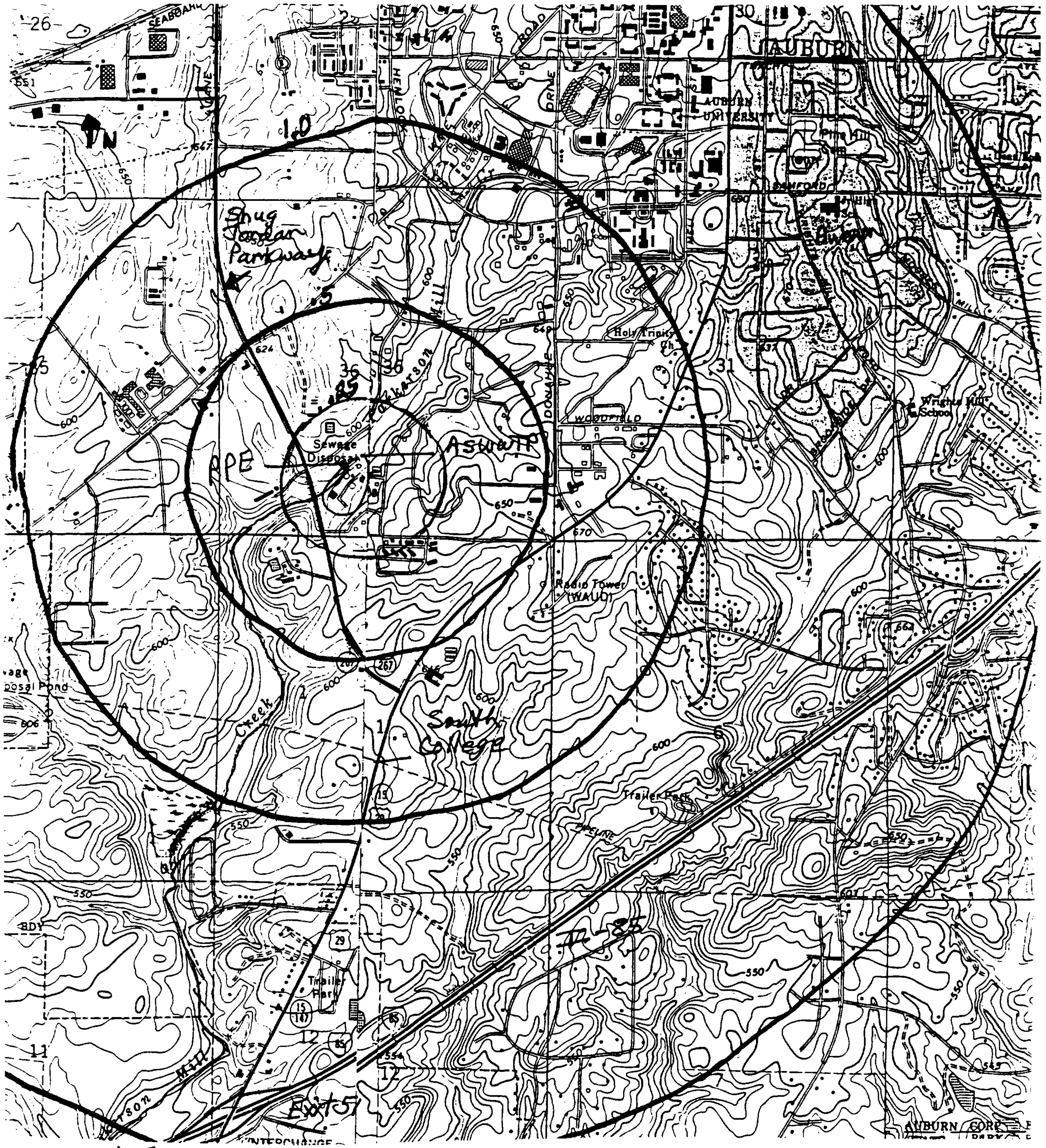
Attachments (2)

ATTACHMENT 3



Aubunn Southside Wastewater Treatment Plant (ASWWTP)

Vicinity Site Sketch – City of Auburn, AL – Comm Panel – 010144-0059D



To Montgomery, AL

Location of Auburn Southside Wastewater Treatment Plant, 7.5 Minute Quad Maps (Loachapoka and Auburn, AL)

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Photographs taken by B. Temple and J. Stamps during site visits to Auburn Southside Wastewater Treatment Plant (ASWWTP) and vicinity on April 5, 1994 and December 9, 1996.

Photo #	Legend
AS-1	First of four photographs (AS-1 through AS-4) showing a panoramic view of the ASWWTP facility from the east to the southwest. Primary filter as viewed from the roadway. A possible manhole and associated pipes (AS-21 through AS-25) are located in the foreground.
AS-2	Southeast view of primary filter showing pipes in foreground and digester at edge of photograph at right behind ADEM personnel.
AS-3	View to the south showing digestor and joint office/laboratory, etc. and roadway to Shug Jordan Parkway. Sludge drying area is beyond the trees at back of photograph while Parkerson Mill Creek lies to the right/west out of view.
AS-4	View to the southwest, as seen from the top of the primary filter, showing the office building, Parkerson Mill Creek running right to left center, the outfall (white concrete) at the center, and Auburn University's pasture beyond creek.
AS-5	View of the inactive primary filter taken from the east. showing removal of rip rap treatment rocks, brick liner on concrete bottom (center), and central column pipe (rusty metal, center). Parkerson Mill Creek lies in background.
AS-6	View from the top of primary filter showing concrete floor, remainder of brick floor liner, and central column upon which trickling arms connected. Mercury was located in the column's rings. Auburn University's hog farm can be seen in upper left/north of ASWWTP.
AS-7	Closer view of central column in primary filter showing rip rap and bricks lining concrete floor.
AS-8	View inside the central column. Note the mercury (silver spots) leaking out of the metal in the rings at the lower right and left of the photograph.

ATTACHMENT 4

Photographs taken by B. Temple and J. Stamps during site visits to Auburn Southside Wastewater Treatment Plant (ASWWTP) and vicinity on April 5, 1994 and December 9, 1996.

Photo #	Legend
AS-9	View of protective covering of another central core at ASWWTP.
AS-10	View of central column showing mercury contaminated rocks surrounding the central core and mercury leaking our of rings (at top). Mr. Wilder, City of Auburn's Sewer Superintendent, is at left.
AS-11	View of central column showing leaking mercury.
AS-12	Portion of central column top showing mercury (white material) leaking out of metal in the rings.
AS-13	Closeup view of AS-12 showing mercery contaminated metal.
AS-14	Drum containing mercury contaminated soil collected by Roy F. Weston, Inc.
AS-15	Plastic containers of liquid mercury collected from the trickling arms of the primary and secondary filtlers being packaged for shipment and disposal.
AS-16	Overpacked containers of liquid mercury packed for shipment and disposal.
AS-17	Appropriate overpacked containers of liquid mercury packed for shipment and disposal were staged in locked building onsite.
AS-18	Inspection galley of primary filter located at north end of tank. Auburn University's white hog farm buildings can be viewed from the primary filter tank.
AS-19	View of the bottom of the inspection galley (AS-18).
AS-20	Sample of rip rap and brick ("DICKEY CLAY HERIDLAN MISS") from primary filter floor.
AS-21 to AS-25	Photographs of possible manhole and pipes located between the roadway and primary filter (leading to and from unknown location)(see AS-1).

Photographs taken by B. Temple and J. Stamps during site visits to Auburn Southside Wastewater Treatment Plant (ASWWTP) and vicinity on April 5, 1994 and December 9, 1996.

Photo #	Legend
AS-26	View of box culvert which empties processed sewage waters into Paterson Mill Creek located to the right out of view.
AS-27	Closeup view of box culvert for processed sewage waters showing that sediment has filled in most of the drainage pipe opening.
AS-28	View of Paterson Mill Creek showing flowing water at the base of the box culvert outfall.

BLT

Dates photographs taken by Bonnie L. Temple:

- December 9, 1996: AS-1 through AS-8; AS-18 through AS-28

Dates photographs taken by Jerremy H. Stamps:

- April 5, 1994: AS-9 through AS-17

UNSCANNABLE

MEDIA

(PHOTOGRAPHS)

OVERSIZED

DOCUMENT

LAND DIVISION - HAZARDOUS WASTE BRANCH - SITE ASSESSMENT UNIT: TELEPHONE CONVERSATION RECORD

Date:	January 15, 1997	ASWWTP **6477**/9109
Time:	8:30 am (I called)	
Conservation with:	Rex Griffin, City Engineer **Don Wilder**, Sewer Superintendent	(334) 887-4980 direct (or 334-887-4911 Ext. 229)
Facility or Company:	City of Auburn Engineering Department P.O. Box 511 171 North Ross Street Auburn, AL 36831-0511	
Regarding:	Obtain Figure 1 of Weston Report August 1994	

1/15/97 8:30 am): Left a message on his voice mail.

B. Temple

BT

ATTACHMENT 6

City of Auburn

HOME OF AUBURN UNIVERSITY

JAN 1997
RECEIVED
LAND DIVISION

Jan. 10.1997

Bonnie Temple
Site Asssessment Unit
Hazardous Waste Branch
ADEM Land Division
P.O. Box 301463
Montgomery, Al. 36130-1463

Dear Ms. Temple,

Enclosed you will find copies of the complete report by Roy F. Weston, Inc concerning the mercury testing at the Old Southside Wastewater plant in Auburn. Also included are copies of the disposal packing slips and acknowledgement of receipt of the hazardous material from Heritage Enviromental Services, Inc.

If you need any additional information, you may contact me at 334-887-4980.

Sincerely,

Don Wilder

Don Wilder, Superintendent
Sewer Maintenance Department

cc: Rex Griffin, Director Sewer/Water Division

P.O. BOX 511 • AUBURN, ALABAMA 36831-0511 • (334) 821-1900
171 NORTH ROSS STREET • FAX NUMBER 887-4996

![HERITAGE]

Generator City of Auburn
Shug Jordan Parkway
Auburn, AL 36830

DOT/Shipping container Drum # 27729-2 20DF
RQ, Waste Mercury, 8, UN230
PG III

Packing List

Check circle when chemical is packed in shipping container.

	Chemical Name	Container size	EPA code	RQ	Item No.
○	Hg contaminated soil	5 gal	[illegible]		
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Date Page of

HERITAGE

Generator: City of Auburn
Shug Jordan Parkway
Auburn, AL 36830

DOT/Shipping container: Drum # 27729-#1 55DM
RQ, Waste Mercury, 8, UN2809, PG III

Packing List

Check circle when chemical is packed in shipping container.

Chemical Name	Container size	EPA code	RQ	Item No.
Hg contaminated soil	~~5 gal X 1~~ Approx 50 lbs	D009		
Hg and debris with 6-10 beakers	~~5 gal X 1~~ Approx. 100 lbs.	D009		
Elemental Mercury	1qt x 2	D009, U151		

Print Name Signature Date Page of

HERITAGE ENVIRONMENTAL SERVICES, INC.

4132 Pompano Road • Charlotte, NC 28216
Telephone 704/392-6276

CERTIFICATE OF TREATMENT AND DISPOSAL

HERITAGE ENVIRONMENTAL SERVICES, INC. CERTIFIES AND ASSURES TO OUR CUSTOMERS THAT THE TRANSACTION DESCRIBED BELOW, INCLUDING TREATMENT AND/OR STORAGE AND/OR RECLAMATION AND/OR DISPOSAL HAS BEEN HANDLED IN COMPLIANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS.

TRANSACTION

GENERATOR:	City of Auburn SHVG Jordan Parkway Auburn, AL 36830
MANIFEST DOCUMENT NUMBER:	12343
HERITAGE DOCUMENT NUMBER:	460060
QUANTITY:	2/Drums RQWaste Poisonous RQ Waste Mercury

Received 10-6-94 [illegible]

HERITAGE

KENNETH S. PRICE, PRESIDENT

WESTON
MANAGERS DESIGNERS/CONSULTANTS
ROY F. WESTON, INC.
1635 PUMPHREY AVE.
AUBURN, AL 36830
PHONE: (205) 826-6100
FAX: (205) 826-8232

24 August 1994

Mr. Rex Griffin
City Engineer
City of Auburn
P.O. Box 155
Auburn, AL 36830

Work Order No. 02871-005-001-0002-05

Re: Contaminated Soil Management Plan
Southside Waste Treatment Facility
Auburn, Alabama 36830

See Attachment 8 for entire report
Blt

Dear Mr. Griffin:

Roy F. Weston, Inc. (WESTON®) conducted a preliminary soil and water investigation at the Southside Waste Treatment Facility located along Shug Jordan Expressway, Auburn, Alabama. The purpose of the investigation was to determine whether potential contaminants are present in residual sludge, grit, and sediments at the facility and whether these potential contaminants have impacted local surface water. The following presents a brief discussion of the procedures and analytical results for this investigation.

SOIL SAMPLING

To establish whether regulated substances are present in residual sludge and grit at the facility, WESTON collected two surface samples within the abandoned sludge drying beds, and one sample within the degritting tank at the facility. In addition, a sediment sample was collected at the primary discharge point into Parkerson Mill Creek. The sample locations are presented in the figure presented as Figure 1.

The samples were collected to a depth of approximately 10 inches below ground surface using a 3.5-inch stainless steel auger. The material was placed into a clean pyrex dish. Samples for volatile organic compounds (VOCs) were collected immediately and stored in an ice chest. After collection of the VOC sample, the soil was blended and additional samples were collected for semivolatiles (SVOC), total petroleum hydrocarbons, and metals analyses.

Any remaining soil was stored until each of the three soil samples were collected. Equal portions of each material were blended for an additional composite sample for toxicity characteristic leachate procedure (TCLP) analysis.

LAND DIVISION - HAZARDOUS WASTE BRANCH - SITE ASSESSMENT UNIT: TELEPHONE CONVERSATION RECORD

Date:	January 8, 1997	ASWWTP 6477/9109
Time:	10:17 am (I called)	
Conservation with:	Rex Griffin, City Engineer **Don Wilder**, Sewer Superintendent	(334) 887-4980
Facility or Company:	City of Auburn Engineering Department P.O. Box 511 171 North Ross Street Auburn, AL 36831-0511	
Regarding:	Obtaining information on the Auburn Southside WWTP flow pattern	

1/8/97 10:17 am): Left a message on his voice mail. He is on the other line.

1/9/97 (9:27 am): Left message on voice mail at another number.
(2:05 pm): Mr. Wilder returned my call. He will locate the Weston Report, copy it and mail it to me. The TPH contaminated soil was disposed of at Salem Landfill (John Narramore, Oct. 20, 1994, IW City of Auburn CF #41-034; S Waste #2753). He wasn't sure about the water in the "aeration arm of the secondary digester". He said the digester doesn't have an aeration arm, perhaps it is a typo and should be secondary filter? The rip rap from the primary filter has been utilized in filling in sunken areas of various roadbeds. Heritage Environmental Services of Charlotte, NC transported the elemental mercury (1 qt. x 2), contaminated metals and ball bearings from the filters. Mr. Wilder expects that any escaped mercury is trapped in the pipes.

Auburn University's Oil Refinery Unit lies at the end of the barracaded road. In 1983-84 (circa early 1980's) the valve of the oil refinery had been left open and drained across ASWWTP.

B. Temple

Blt

City of Auburn

HOME OF AUBURN UNIVERSITY

Jan. 3, 1996

Bonnie Temple
Site Assessment Unit
Hazardous Waste Branch
ADEM Land Division
P.O. Box 301463
Montgomery, Al. 36130-`1463

Dear Ms. Temple,

Enclosed is a copy of the letter from Roy F. Weston, Inc, with the results of their testing of the Southside Waste Treatment Plant on Shug Jordan Parkway in Auburn, Alabama. If you need additional information, please contact me at 334-887-4980.

Sincerely yours,

Don Wilder

Don Wilder, Superintendent
Sewer Maintenance Department

cc: Rex Griffin; Director Sewer and Water
Jeff Ramsey , City Engineer.

COPY

P.O. BOX 511 • AUBURN, ALABAMA 36831-0511 • (334) 821-1900
171 NORTH ROSS STREET • FAX NUMBER 887-4996

WESTON
MANAGERS DESIGNERS/CONSULTANTS
ROY F. WESTON, INC.
1635 PUMPHREY AVE.
AUBURN, AL 36830
PHONE: (205) 826-6100
FAX: (205) 826-8232

24 August 1994

Mr. Rex Griffin
City Engineer
City of Auburn
P.O. Box 155
Auburn, AL 36830

Work Order No. 02871-005-001-0002-05

Re: Contaminated Soil Management Plan
Southside Waste Treatment Facility
Auburn, Alabama 36830

Dear Mr. Griffin:

Roy F. Weston, Inc. (WESTON®) conducted a preliminary soil and water investigation at the Southside Waste Treatment Facility located along Shug Jordan Expressway, Auburn, Alabama. The purpose of the investigation was to determine whether potential contaminants are present in residual sludge, grit, and sediments at the facility and whether these potential contaminants have impacted local surface water. The following presents a brief discussion of the procedures and analytical results for this investigation.

SOIL SAMPLING

To establish whether regulated substances are present in residual sludge and grit at the facility, WESTON collected two surface samples within the abandoned sludge drying beds, and one sample within the degritting tank at the facility. In addition, a sediment sample was collected at the primary discharge point into Parkerson Mill Creek. The sample locations are presented in the figure presented as Figure 1.

The samples were collected to a depth of approximately 10 inches below ground surface using a 3.5-inch stainless steel auger. The material was placed into a clean pyrex dish. Samples for volatile organic compounds (VOCs) were collected immediately and stored in an ice chest. After collection of the VOC sample, the soil was blended and additional samples were collected for semivolatiles (SVOC), total petroleum hydrocarbons, and metals analyses.

Any remaining soil was stored until each of the three soil samples were collected. Equal portions of each material were blended for an additional composite sample for toxicity characteristic leachate procedüre (TCLP) analysis.

WATER SAMPLES

Water samples were collected to determine whether past operations at the facility had impacted waters within the Parkerson Mill Creek. Four water samples were collected. These included one sample from the primary discharge point, one sample from the aeration arm of the secondary filter, one sample upstream of the treatment facility in Parkerson Mill Creek, and one downstream of the facility in Parkerson Mill Creek. The sample locations are presented in Figure 1. Water samples were collected directly from the sample locations into appropriate containers. Water samples from each location were collected for VOC, and total metals analyses.

ANALYTICAL RESULTS

Analytical results for the soil, sediment and water samples are presented in Tables 1 and 2. The analytical reports are presented in Exhibit 1.

Soil Samples

The analytical results for the soil samples indicated high levels of total petroleum hydrocarbons (TPH) with a maximum concentration detected in sample SWTF-SS-01 at 2280 mg/kg. This sample was collected from the sludge drying beds in an area with residual sludge overlying the gravel bed. TPH concentrations ranged from 192 mg/kg to 2280 mg/kg.

Analytical results for total metals indicated elevated concentrations of most of the Resource Conservation Recovery Act (RCRA) metals. The metals with the highest concentrations detected included barium, chromium, nickel, and lead. Mercury was also detected with a maximum concentration of 13.9 mg/kg (See Table 1 and Exhibit 1).

One composite sample was collected from each of the soil sample locations for TCLP analysis. The analytical results did not indicate any elevated VOCs, semivolatiles (SVOCs), or pesticides/herbicides above detection limits. However, the metal nickel was detected at a concentration of 0.16 mg/l.

Water Samples

A total of four water samples were collected for analysis. The analytical results are summarized in Table 2. The analytical reports are presented in Exhibit 1.

The samples did not indicate any elevated concentrations of VOCs. The metals analyses indicated elevated concentrations of barium and lead in the samples collected from the primary discharge point, and the upstream and downstream samples from Parkerson Mill Creek. The presence of these metals in similar concentrations in each of the samples suggests that they are being discharged from a source other than the wastewater treatment facility. The highest concentration of lead was in the sample from the primary discharge point at 0.014 mg/l. The current Alabama drinking water maximum contaminant level (MCL) for lead is 0.015 mg/l. The sample collected from the aeration arm of the secondary filter indicated elevated levels of mercury and lead (see Table 2). The mercury is probably due to leakage from the mercury seal on the unit.

SUMMARY

Analytical results for TPH in soils indicated a maximum concentration of 2280 mg/kg. Since the petroleum constituents are derived from a mixed source, the waste may potentially be classified as used heavy petroleum waste. According to the Alabama Department of Environmental Management (ADEM) Division 13, Solid Waste Program, Guidelines for the Disposal of Non-Hazardous Petroleum Contaminated Wastes (December 02, 1991), these wastes may be disposed of at a select disposal facility at concentrations up to 3,000 mg/kg as long as the material is non-hazardous. A copy of the State guidelines is presented in Exhibit 2. TCLP results from the composite sample collected at the site indicated nickel concentrations of 0.16 mg/l. According to ADEM, this concentration does not classify the material as hazardous. As a result, the residual sludge at the facility may be regarded as non-hazardous; however, due to the TPH concentrations the waste will require disposal at an approved Municipal Solid Waste Landfill. As the TPH concentration is below 3,000 ppm, the landfill does not have to be lined. The closest landfill which could accept this class of waste is the Salem Waste Disposal Center, Salem, Alabama. This is a Subtitle D municipal landfill. Additional information may be acquired from ADEM by contacting Mr. Lindsey Mothershed of the ADEM Solid Waste group at (205) 271-7765.

The surface water samples exhibited elevated concentrations of barium and lead. As the metals were detected in all of the samples in similar concentrations, these metals may occur naturally or be from a source other than the wastewater treatment facility. However, the lead concentration from the primary discharge point was significantly higher suggesting a secondary source. The concentration detected was 0.014 mg/l. Current MCL for lead based on the Federal Drinking Water Standards is 0.015 mg/l. As the level detected suggests a secondary source for the contaminant, further investigation and response may be required by ADEM. A minimum response would be to eliminate the discharge from the system by either removal of the system or sealing the discharge point. Although the level detected is below drinking water standards, these MCLs do not directly apply to this type of discharge and can only be used as a general guidance as to the magnitude of the release. ADEM should be contacted to establish whether the discharge is in violation of surface water regulations and require permitting. Mr. Dennis Harrison of the ADEM Municipal Water group may be contacted at (205) 271-7801. The water collected from the aeration arm of the secondary digester exhibited elevated mercury and lead levels. It is recommended that this water be contained and disposed in accordance with current State and Federal guidelines.

WESTON

Mr. Rex Griffin
City of Auburn -4- 24 August 1994

WESTON appreciates the opportunity to work with the City of Auburn on this matter. Should you have any questions or require additional services, please contact Mr. Ron Thompson or Mr. Frank Burgess at 205-826-6100.

Sincerely,

ROY F. WESTON, INC.

Ronald T. Thompson

Ronald T. Thompson
Project Director

rf

Enclosure

LAND DIVISION - HAZARDOUS WASTE BRANCH - SITE ASSESSMENT UNIT: TELEPHONE CONVERSATION RECORD

Date:	January 3, 1997	ASWWTP **6477**/9109
Time:	10:43 am (I called)	
Conservation with:	Rex Griffin, City Engineer **Don Wilder**, Sewer Superintendent	(334) 887-4910
Facility or Company:	City of Auburn Engineering Department P.O. Box 511 171 North Ross Street Auburn, AL 36831-0511	
Regarding:	Obtaining information on the Auburn Southside WWTP flow pattern	

He has found the information needed but could not see any notation that it was sent to ADEM Special Projects. He will send the information possibly today.

B. Temple

BCT

LAND DIVISION - HAZARDOUS WASTE BRANCH - SITE ASSESSMENT UNIT: TELEPHONE CONVERSATION RECORD

Date:	December 18, 1996	ASWWTP 6477/9109
Time:	1:10 pm (I called)	
Conservation with:	Rex Griffin, City Engineer **Don Wilder**, Sewer Superintendent	(334) 887-4910
Facility or Company:	City of Auburn Engineering Department P.O. Box 511 171 North Ross Street Auburn, AL 36831-0511	
Regarding:	Obtaining information on the Auburn Southside WWTP flow pattern	

12/18/96 (1:21 pm): Mr. Griffin is unavailable--left message for Mr. Wilder.

(1:25 pm): Don Wilder explained that sewage was broken up and passed to the primary filter. Gravity feeding of sewage occurred along the processing pathway. The sewage passed through the trickling arms of the primary filter down through the rip rap filter, past the open brickwork and into a pipe leading to the secondary filter. From the secondary filter sewage passes through pipes to the final clarifier. The primary and secondary clarifiers have been demolished and filled in. All the valves along the pathway have been closed. Mr. Wilder believes that the missing mercury lies somewhere in the pipes between the primary and secondary filters. Roy F. Weston, Inc. sampled and evaluated ASWWTP site and removed contaminated soil and captured mercury. Mr. Wilder will search for their reports and submit them to me next week.

The ASWWTP property actually belongs to Auburn University. The City of Auburn are its tenants. The property was deeded to the City of Auburn for as long as it was utilized as a sewer operation. Once operations ceased, the property reverted back to the Auburn University. Auburn University would like the City to clean up and remove any contamination, pipes, and tanks before returning the property to them. Mr. Wilder is still utilizing the property for storage of the City's sewage materials.

There has never been any address for the site expect Shug Jordan Parkway.

B. Temple

BLT

(271-7?

Jeremy:
Please call Jerry Shipman with this info and we will get the ID # for Auburn. He started the paperwork yesterday + needs this to finish.
Thanks,
Jymalyn

WESTON
MANAGERS DESIGNERS/CONSULTANTS
1635 PUMPHREY AVENUE
AUBURN, AL 36830-4303
205-826-6100 • FAX: 205-826-8232

South Uni
Univ #
AL 2050737

FACSIMILE TRANSMITTAL

FAX: 205-826-8232

TO: JYMALYN REDMOND
ADEM - SPECIAL PROJECTS

Recipient's Telecopy Telephone # 205-260-2795
Recipient's Confirmation Telephone #

FROM: FRANK BURGESS

205-826-6100
Originator's Telephone #

TOTAL PAGES: 1 (incl. cover sheet)

CHARGE #:

ORIGINAL WILL:
____ Follow via mail
____ Follow via messenger
____ Follow via overnight service
____ Not be sent

TAMEKA MELTON
(Sent By)

(Sender's Telephone #)

(Date) / (Time)

COMMENTS:

JYMALYN,

HERE IS THE INFO YOU REQUESTED TO ISSUE AN ID # FOR MERCURY DISPOSAL FOR THE CITY OF AUBURN. THANKS FOR ALL YOUR HELP. FRANK

GENERATOR	TRANSPORTER	DISPOSAL
CITY OF AUBURN, ALABAMA	HERITAGE TRANSPORT, INC	HERITAGE ENVIRONMENTAL SERVICES
C/O REX GRIFFIN	7901 W. MORRIS ST	4132 POMPANO ROAD
P.O. BOX 511	INDIANAPOLIS, IN 46231	CHARLOTTE, NC 28216
AUBURN, AL 36830	EPA ID: IND 058484114	EPA ID: NCD 121700777

RFW 04-02-006/A-04/93

ID #
ALT MPQ QQ1573

ATTACHMENT 7

WESTON®
MANAGERS DESIGNERS/CONSULTANTS
1635 PUMPHREY AVENUE
AUBURN, AL 36830-4303
205-826-6100 • FAX: 205-826-8232

FACSIMILE TRANSMITTAL

FAX: 205-826-8232

TO: Jymalyn Redmond
ADEM - Special Projects

Recipient's Telecopy
Telephone # 205-260-2795

Recipient's Confirmation
Telephone # ____

FROM: Frank Burgess

205-826-6100
Originator's Telephone #

TOTAL PAGES: 1 (incl. cover sheet)

CHARGE #: ____

ORIGINAL WILL:
____ Follow via mail
____ Follow via messenger
____ Follow via overnight service
____ Not be sent

TAMEKA MELTON
(Sent By)

(Sender's Telephone #)

(Date) / (Time)

COMMENTS:

Jymalyn,
Here is the info you requested to issue an ID # for mercury disposal for the City of Auburn. Thanks for all your help. Frank

Generator	Transporter	Disposal
City of Auburn, Alabama	Heritage Transport, Inc	Heritage Environmental Services
c/o Rex Griffin	7901 W. Morris St	4132 Pompano Road
P.O. Box 511	Indianapolis, IN 46231	Charlotte, NC 28216
Auburn, AL 36830	EPA ID: IND 058484114	EPA ID: NCD 121700777

ID # ALTMPQQ01573

ADEM

ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

James W. Warr, Director

Jim Folsom
Governor

Mailing Address:
PO BOX 301463
MONTGOMERY AL
36130-1463

Physical Address:
1751 Cong. W. L.
Dickinson Drive
Montgomery, AL
36109-2608

(205) 271-7700
FAX 270-5612

Field Offices:

110 Vulcan Road
Birmingham, AL
35209-4702
(205) 942-6168
FAX 941-1603

400 Well Street
P.O. Box 953
Decatur, AL
35602-0953
(205) 353-1713
FAX 340-9359

2204 Perimeter Road
Mobile, AL
36615-1131
(205) 450-3400
FAX 479-2593

April 14, 1994

MEMORANDUM

TO: Jymalyn E. Redmond, Chief
Site Assessment Unit
Special Projects

FROM: Jerremy H. Stamps
Site Assessment Unit
Special Projects

SUBJECT: Southside waste-water Treatment Plant trip report
Auburn, Alabama

On April 5, 1994, I met with Don Wilder at the city of Auburn's Engineering Department to discuss the problems at the Southside Waste-water Treatment Plant and to take a look at the facility. Mr. Wilder informed me that the treatment plant was a trickling filter system built in 1958 and closed in December of 1985. The system had three trickle arm apparatuses all of which are designed to contain approximately 40 to 45 pounds of mercury in a fitting on which the trickling arms rotate. During demolition of the 6.8 acre facility, Mr. Wilder realized that the mercury was missing in two of the three trickling arm fittings. This would mean that 70 to 80 pounds of mercury has escaped out of the fittings. Mr. Wilder told me that the mercury should still be somewhere in the facilities piping or at the bottom of a 100 foot diameter 5 foot deep concrete filter tank filled with large crushed stone (rip rap).

After a short conversation, Mr. Wilder and I went to the treatment plant and meet Frank Burgess. Mr. Burgess works for Roy F. Weston Inc. who has been contracted to do the environmental cleanup of the facility. Mr. Wilder showed me the mercury that he and Mr. Burgess had collected. The mercury was locked in a building and contained in two chemical resistant plastic bottles which were wrapped in plastic bags and placed in five gallon bucket with a secure lid on top. In an adjacent trailer a 55-gallon drum of contaminated soil was also staged and ready for disposal. Mr. Burgess asked me if I could get them an **emergency ID number** for the mercury and contaminated soil so that it could be transported to a landfill or a recycler.

After looking at the waste and how it was being stored, Mr. Wilder and Mr. Burgess took me to the locations of the primary and secondary filters. The secondary filter had only one trickling arm and the primary filter had two. Out of the secondary filter, approximately 43 pounds of mercury was collected from its trickling arm fitting. In the primary filter, approximately 2 pounds of mercury was collected from one of the two trickling arm fittings. The other trickling arm fitting of the primary filter contained little to no mercury. A few days prior to my visit all of the fittings were vacuumed to remove the small beads of mercury that remained on the metal surfaces of the fittings.

During my visit it was discovered that more mercury had bleed out of the rusted metal fittings. Small beads of mercury were also seen on the rocks surrounding primary filter fitting that was found to be empty of all of its mercury. From this we concluded that it was more probable that the mercury had leaked out of the drain plug on the side of the fitting and then drained through the rip rap to the bottom of the concrete filter.

The concrete filter is designed with drainage brick on the bottom which slope to the center of the filter. Therefore, the mercury should be concentrated in one central location. Mr. Wilder asked me if he could use the rip rap in the filter as base stone and fill material on roads in Auburn. I told him to wait on removing any of the stone until I could talk to my supervisor about the situation. Most of the 100' X 100' X 5' pile of rip rap is not contaminated, but keeping what is not contaminated separate from what is poses a definite problem. Disposing of all of the rip rap as contaminated waste would also pose a significant problem based on the quantity and cost of disposal.

Mr. Wilder was also concerned with the disposal of the trickling arm fitting and all the other metal piping connected to it because each of the trickling apparatuses weighs several thousand pounds and disposal costs are based on weight. I told Mr. Wilder that only the fitting area appears to be contaminated with mercury and that it may be possible to cut the contaminated area off and only have that part of the apparatus disposed of in a hazardous waste land fill if it could be proven that the rest of the apparatus is not contaminated.

I would recommend that we meet to discuss this site and to schedule another site visit so that you can get a better perspective on the size of the site and what kind of problems will be involved in the clean-up.

This concludes the Southside Wastewater Treatment Plant trip report for the April 5, 1994, site visit.

SITE DISCOVERY FORM

Part 1: Information necessary to add a site to CERCLIS

ACTION A

EPA ID: ______________________

SITE NAME: SOUTHSIDE WASTE WATER TREATMENT PLANT SOURCE: __ (R=EPA, T=STATE)

STREET: OFF OF .SHUG JORDAN PKY CONG DIST: __ (Optional)

CITY: AUBURN ZIP: 38630 - ____

COUNTY NAME: LEE COUNTY CODE: ____ (Optional)

LATITUDE: __ / __ / ___ LONGITUDE: ___ / __ / ____ (Optional)

INVENTORY IND: Y REMEDIAL IND: Y REMOVAL IND: N FED FAC IND: N

RPM NAME: ______________________ RPM PHONE: ___ - ___ - ____ (EPA Project Office)

SITE DESCRIPTION: (Optional)

AUBURN SOUTHSIDE WASTE WATER TREATMENT PLANT CLOSED IN 1985. MERCURY FROM TWO OF THREE TRICKLE ARM FITTINGS HAD ESCAPED. ESTIMATED 70-80 LBS TOTAL SHOULD BE SOMEWHERE IN THE FACILITY PIPING OR IN THE BOTTOM OF A 100 FT DIAMATER 5 FEET DEEP CONCRETE FILTER TANK FILLED WITH LARGE CRUSHED STONE

Part 2: Other site information

DATE SITE FIRST REPORTED: 3 / 15 / 94 REPORTED BY: CITY OF AUBURN

REASON FOR LISTING: DISCOVERY OF POSSIBLE MERCURY SPILL AT THE ABANDONED SOUTHSIDE WASTE WATER TREATMENT PLANT.

ADEM

ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Fob James, Jr
Governor

James W. Warr
Acting Director

(334) 271-7700

1751 Cong. W. L.
Dickinson Drive
Montgomery, AL
36109-2608

Mailing Address:
PO Box 301463
Montgomery, AL
36130-1463

FAX: (334)
Admin: 271-7950
Air: 279-3044
Land: 279-3050
Water: 279-3051
Sp Proj: 213-4399
Field Ops: 272-8131
Backup: 270-5612

Field Offices:

110 Vulcan Road
Birmingham, AL
35209-4702
(205) 942-6168
FAX: 941-1603

400 Well St, N E
P O Box 953
Decatur, AL
35602-0953
(205) 353-1713
FAX: 340-9359

2204 Perimeter Rd
Mobile, AL
36615-1131
(334) 450-3400
FAX: 479-2593

February 22, 1996

Mr. Brian Farrier
CERCLA PA/SI Regional Project Officer
Region IV US EPA
345 Courtland Street
Atlanta, Georgia 30365

Dear Mr. Farrier:

Enclosed you will find a site discovery forms for the following:

Triana Plume
Anchor Metals
Old Mutual Oil Site
Sullivan Graphics
Trinity Industries
Southsite Waste-Water Treatment Plant

Please advise us when a reference number has been assigned to these sites.

Should you have questions or require assistance in evaluating this form, please do not hesitate to contact our staff.

Sincerely,

Jymalyn E. Redmond

Jymalyn E. Redmond, Chief
Site Assessment Unit

JER/tpc

City of Auburn

HOME OF AUBURN UNIVERSITY

March 15, 1994

Ms. Jymalyn Redmond
Alabama Department of Environmental Management
P. O. Box 301463
Montgomery, AL 36130-1463

Dear Ms. Redmond:

On February 10, 1994, I notified Mr. Jerimy Stamps of your office that the City of Auburn had discovered a possible mercury spill. The apparent spill was at the abandoned Southside Wastewater Treatment Plant. We believe that due to the valves being closed and the final clarifier being filled with dirt, the mercury is contained on site.

The City has retained Roy F. Weston, Inc., an independent testing firm, to test and evaluate the site as to the extend of the possible contamination. I will forward you a copy of their report upon its completion and advise you of the procedure we will follow for any necessary clean-up.

If you have any questions concerning this matter, please contact myself or Rex Griffin, City Engineer, at 887-4910

Sincerely,

Don Wilder
Sewer Superintendent

kt

cc: Rex Griffin
Jerimy Stamps

JRedmond.ADM

P.O. BOX 511 • AUBURN, ALABAMA 36831-0511 • (205) 821-1900
171 NORTH ROSS STREET • FAX NUMBER 887-4996

ROY F. WESTON, INC.
1635 PUMPHREY AVE.
AUBURN, AL 36830
PHONE: (205) 826-6100
FAX: (205) 826-8232

24 August 1994

Mr. Rex Griffin
City Engineer
City of Auburn
P.O. Box 155
Auburn, AL 36830

Work Order No. 02871-005-001-0002-05

Re: Contaminated Soil Management Plan
Southside Waste Treatment Facility
Auburn, Alabama 36830

Dear Mr. Griffin:

Roy F. Weston, Inc. (WESTON®) conducted a preliminary soil and water investigation at the Southside Waste Treatment Facility located along Shug Jordan Expressway, Auburn, Alabama. The purpose of the investigation was to determine whether potential contaminants are present in residual sludge, grit, and sediments at the facility and whether these potential contaminants have impacted local surface water. The following presents a brief discussion of the procedures and analytical results for this investigation.

SOIL SAMPLING

To establish whether regulated substances are present in residual sludge and grit at the facility, WESTON collected two surface samples within the abandoned sludge drying beds, and one sample within the degritting tank at the facility. In addition, a sediment sample was collected at the primary discharge point into Parkerson Mill Creek. The sample locations are presented in the figure presented as Figure 1.

The samples were collected to a depth of approximately 10 inches below ground surface using a 3.5-inch stainless steel auger. The material was placed into a clean pyrex dish. Samples for volatile organic compounds (VOCs) were collected immediately and stored in an ice chest. After collection of the VOC sample, the soil was blended and additional samples were collected for semivolatiles (SVOC), total petroleum hydrocarbons, and metals analyses.

Any remaining soil was stored until each of the three soil samples were collected. Equal portions of each material were blended for an additional composite sample for toxicity characteristic leachate procedure (TCLP) analysis.

ATTACHMENT 8

WATER SAMPLES

Water samples were collected to determine whether past operations at the facility had impacted waters within the Parkerson Mill Creek. Four water samples were collected. These included one sample from the primary discharge point, one sample from the aeration arm of the secondary filter, one sample upstream of the treatment facility in Parkerson Mill Creek, and one downstream of the facility in Parkerson Mill Creek. The sample locations are presented in Figure 1. Water samples were collected directly from the sample locations into appropriate containers. Water samples from each location were collected for VOC, and total metals analyses.

ANALYTICAL RESULTS

Analytical results for the soil, sediment and water samples are presented in Tables 1 and 2. The analytical reports are presented in Exhibit 1.

Soil Samples

The analytical results for the soil samples indicated high levels of total petroleum hydrocarbons (TPH) with a maximum concentration detected in sample SWTF-SS-01 at 2280 mg/kg. This sample was collected from the sludge drying beds in an area with residual sludge overlying the gravel bed. TPH concentrations ranged from 192 mg/kg to 2280 mg/kg.

Analytical results for total metals indicated elevated concentrations of most of the Resource Conservation Recovery Act (RCRA) metals. The metals with the highest concentrations detected included barium, chromium, nickel, and lead. Mercury was also detected with a maximum concentration of 13.9 mg/kg (See Table 1 and Exhibit 1).

One composite sample was collected from each of the soil sample locations for TCLP analysis. The analytical results did not indicate any elevated VOCs, semivolatiles (SVOCs), or pesticides/herbicides above detection limits. However, the metal nickel was detected at a concentration of 0.16 mg/l.

Water Samples

A total of four water samples were collected for analysis. The analytical results are summarized in Table 2. The analytical reports are presented in Exhibit 1.

The samples did not indicate any elevated concentrations of VOCs. The metals analyses indicated elevated concentrations of barium and lead in the samples collected from the primary discharge point, and the upstream and downstream samples from Parkerson Mill Creek. The presence of these metals in similar concentrations in each of the samples suggests that they are being discharged from a source other than the wastewater treatment facility. The highest concentration of lead was in the sample from the primary discharge point at 0.014 mg/l. The current Alabama drinking water maximum contaminant level (MCL) for lead is 0.015 mg/l. The sample collected from the aeration arm of the secondary filter indicated elevated levels of mercury and lead (see Table 2). The mercury is probably due to leakage from the mercury seal on the unit.

SUMMARY

Analytical results for TPH in soils indicated a maximum concentration of 2280 mg/kg. Since the petroleum constituents are derived from a mixed source, the waste may potentially be classified as used heavy petroleum waste. According to the Alabama Department of Environmental Management (ADEM) Division 13, Solid Waste Program, Guidelines for the Disposal of Non-Hazardous Petroleum Contaminated Wastes (December 02, 1991), these wastes may be disposed of at a select disposal facility at concentrations up to 3,000 mg/kg as long as the material is non-hazardous. A copy of the State guidelines is presented in Exhibit 2. TCLP results from the composite sample collected at the site indicated nickel concentrations of 0.16 mg/l. According to ADEM, this concentration does not classify the material as hazardous. As a result, the residual sludge at the facility may be regarded as non-hazardous; however, due to the TPH concentrations the waste will require disposal at an approved Municipal Solid Waste Landfill. As the TPH concentration is below 3,000 ppm, the landfill does not have to be lined. The closest landfill which could accept this class of waste is the Salem Waste Disposal Center, Salem, Alabama. This is a Subtitle D municipal landfill. Additional information may be acquired from ADEM by contacting Mr. Lindsey Mothershed of the ADEM Solid Waste group at (205) 271-7765.

The surface water samples exhibited elevated concentrations of barium and lead. As the metals were detected in all of the samples in similar concentrations, these metals may occur naturally or be from a source other than the wastewater treatment facility. However, the lead concentration from the primary discharge point was significantly higher suggesting a secondary source. The concentration detected was 0.014 mg/l. Current MCL for lead based on the Federal Drinking Water Standards is 0.015 mg/l. As the level detected suggests a secondary source for the contaminant, further investigation and response may be required by ADEM. A minimum response would be to eliminate the discharge from the system by either removal of the system or sealing the discharge point. Although the level detected is below drinking water standards, these MCLs do not directly apply to this type of discharge and can only be used as a general guidance as to the magnitude of the release. ADEM should be contacted to establish whether the discharge is in violation of surface water regulations and require permitting. Mr. Dennis Harrison of the ADEM Municipal Water group may be contacted at (205) 271-7801. The water collected from the aeration arm of the secondary digester exhibited elevated mercury and lead levels. It is recommended that this water be contained and disposed in accordance with current State and Federal guidelines.

TABLE 1. SUMMARY OF SOIL ANALYTICAL RESULTS

SAMPLE NO.	SAMPLE LOCATION	SAMPLE MEDIA	PARAMETER DETECTED	ANALYTICAL RESULTS
SWTF-SS-01	SLUDGE DRYING BEDS	SLUDGE GRAVEL	TPH	2280 mg/kg
			Silver[1] Arsenic Barium Cadmium Chromium Mercury Nickel Lead Selenium	48.5 mg/kg 1.1 mg/kg 398.0 mg/kg 5.1 mg/kg 569.0 mg/kg 13.9 mg/kg 159.0 mg/kg 215 mg/kg 2.0 mg/kg
SWTF-SS-02	SLUDGE DRYING BEDS	SLUDGE CLAY/GRAVEL	TPH	1270 mg/kg
			Arsenic[1] Barium Chromium Mercury Nickel Lead Selenium	2.3 mg/kg 42.9 mg/kg 10.7 mg/kg 0.080 mg/kg 3.6 mg/kg 10 mg/kg 1.3 mg/kg
SWTF-SS-03	DEGRITTING TANK	SEDIMENTS	TPH	1730 mg/kg
			Silver[1] Arsenic Barium Cadmium Chromium Mercury Nickel Lead	2.4 mg/kg 3.8 mg/kg 158.0 mg/kg 2.1 mg/kg 108 mg/kg 1.8 mg/kg 33.5 mg/kg 106.0 mg/kg
SWTF-SD-01	PRIMARY DISCHARGE POINT	SEDIMENT	TPH	192 mg/kg
			Arsenic[1] Barium Chromium Mercury Nickel Lead Selenium	0.98 mg/kg 43.4 mg/kg 10/9 mg/kg 0.16 mg/kg 5.0 mg/kg 11.3 mg/kg 0.33 mg/kg
SWTF-COMP-01	COMPOSITE OF SS-01, SS-02, AND SS-03	SOIL SEDIMENT	TCLP VOCs	NONE DETECTED
			TCLP SVOCs	NONE DETECTED
			TCLP PESTICIDES/HERBICIDES	NONE DETECTED
			TCLP METALS Nickel	0.16 mg/l

TABLE 2. SUMMARY OF WATER ANALYTICAL RESULTS

SAMPLE NO.	SAMPLE LOCATION	SAMPLE MEDIA	PARAMETER DETECTED	ANALYTICAL RESULTS
SWTF-W-01	PRIMARY DISCHARGE POINT	WATER	VOC	NONE DETECTED
			Barium Lead	0.056 mg/l 0.014 mg/l
SWTF-W-02	SECONDARY DIGESTER AERATION ARM	WATER	VOC	NONE DETECTED
			Mercury Lead	0.018 mg/l 0.0048 mg/l
SWTF-WU-01	PARKERSON MILL CK. UPSTREAM	WATER	VOC	NONE DETECTED
			Barium Lead	0.053 mg/l 0.0073 mg/l
SWTF-WD-01	PARKERSON MILL CK. DOWNSTREAM	WATER	VOC	NONE DETECTED
			Barium Lead	0.051 mg/l 0.0064 mg/l

EXHIBIT 1

WESTON MANAGERS DESIGNERS CONSULTANTS

STANDARD - GLOSSARY OF DATA QUALIFIERS AND ABBREVIATIONS

Inorganic Data Qualifiers

U Analyte was not detected at or above the reporting limit

X Result obtained indirectly through calculation based on results from other analyses

Organic Data Qualifiers

B Compound was found in the blank and the sample

D Surrogate or matrix spike recoveries were not obtained because the extract was diluted for analysis

E Concentration exceeds the instrument calibration range and was subsequently diluted

I Appears on the "results spreadsheet" to indicate an interference

J Result is an estimated value below the reporting limit or a tenatively identified compound (TIC)

T Compound was found in the TCLP extraction blank and the sample

U Compound was not detected at or above the reporting limit

Abbreviations

BS Blank Spike: spike analysis was conducted on reagent grade water or a matrix free from the analyte(s) of interest.

BSD Blank Spike Duplicate

BRL Below Reporting Limit

CD Calculation Factor used by the laboratory's Information Management System (LIMS)

DF Dilution Factor

DL Appears in the sample ID to indicate a secondary dilution was performed

LCS or (LC) denotes Laboratory Control Standard

MB Method Blank or (PB) preparation blank

MS Matrix Spike

MSD Matrix Spike Duplicate

NA Not Applicable

NC Non-calculable precision due to insufficient concentration of analyte present in the sample

NR Not Required

NS Not Spiked

RE Appears in the sample ID to indicate a Re-analysis

REP Replicate analysis

REPREP Sample was reprepared and then reanalyzed

RFW# Equivalent to the laboratory sample identification (LAB ID)

RPD Relative Percent Difference of duplicate analyses

RRF Relative Response Factor

RT Retention Time

RTW Retention Time Window

NOTES:

- One or a combination of these data qualifiers and abbreviations may appear in the analytical report.
- Soil, sediment and sludge results are reported on a dry weight basis except when analyzed for landfill disposal or incineration parameters. All other results on a solid matrix are reported on an "as received" basis unless noted differently.
- Reporting limits are adjusted for preparation sample size, sample dilutions and sample moisture content if analyzed on a dry weight basis.

Roy F. Weston, Inc. - Gulf Coast Laboratories
INORGANIC ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SWTF-SS-01							
% SOLIDS	001	S	94GTS260	07/18/94	07/20/94	07/27/94	07/27/94
PETROLEUM HYDROCARBO	001	S	94GIR130	07/18/94	07/20/94	07/21/94	07/22/94
SWTF-SS-02							
% SOLIDS	002	S	94GTS260	07/18/94	07/20/94	07/27/94	07/27/94
PETROLEUM HYDROCARBO	002	S	94GIR130	07/18/94	07/20/94	07/21/94	07/22/94
SWTF-SS-03							
% SOLIDS	003	S	94GTS260	07/18/94	07/20/94	07/27/94	07/27/94
PETROLEUM HYDROCARBO	003	S	94GIR130	07/18/94	07/20/94	07/21/94	07/22/94
PETROLEUM HYDROCARBO	003 REP	S	94GIR130	07/18/94	07/20/94	07/21/94	07/22/94
PETROLEUM HYDROCARBO	003 MS	S	94GIR130	07/18/94	07/20/94	07/21/94	07/22/94
SWTF-SD-01							
% SOLIDS	004	S	94GTS260	07/18/94	07/20/94	07/27/94	07/27/94
PETROLEUM HYDROCARBO	004	S	94GIR130	07/18/94	07/20/94	07/21/94	07/22/94
SWTF-Comp-01							
TCLP	005	S		07/18/94	07/20/94		07/26/94
TCLP VOLATILES	005	S		07/18/94	07/20/94		07/28/94

LAB QC:

% SOLIDS	MB1	W	94GTS260	N/A	N/A	07/27/94	07/27/94
PETROLEUM HYDROCARBO	LCS BS	W	94GIR130	N/A	N/A	07/21/94	07/22/94
PETROLEUM HYDROCARBO	LCS BSD	W	94GIR130	N/A	N/A	07/21/94	07/22/94
PETROLEUM HYDROCARBO	MB1	W	94GIR130	N/A	N/A	07/21/94	07/22/94

SIGNATURE Diane L. Harper DATE 7-29-94

NY CERTIFICATION # 11006

WESTON
MANAGERS DESIGNERS/CONSULTANTS

WESTON-GULF COAST, INC.
2417 Bon… , University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Friday July 29th, 1994

RE: **SWTF-SS-01**
Project # 02871-005-001-0002
Lab ID: **9407G302-001**
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result	Units	Reporting Limit
% Solids	84.6	%	0.10
Petroleum Hydrocarbon	2280	mg/kg	153

WESTON LF COAST, INC.
2417 Bond St., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Friday July 29th, 1994

RE: **SWTF-SS-02**
Project # 02871-005-001-0002
Lab ID: **9407G302-002**
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result	Units	Reporting Limit
% Solids	90.9	%	0.10
Petroleum Hydrocarbon	1270	mg/kg	56.9

WESTON
MANAGERS DESIGNERS/CONSULTANTS

WESTON-GULF COAST, INC.
2417 Bor. .t., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Friday July 29th, 1994

RE: SWTF-SS-03
Project # 02871-005-001-0002
Lab ID: 9407G302-003
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result	Units	Reporting Limit
% Solids	65.5	%	0.10
Petroleum Hydrocarbon	1730	mg/kg	76.6

WESTON
MANAGERS DESIGNERS/CONSULTANTS

WESTON· '.F COAST, INC.
2417 Bond St., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Friday July 29th, 1994

RE: **SWTF-SD-01**
Project # 02871-005-001-0002
Lab ID: **9407G302-004**
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result	Units	Reporting Limit
% Solids	60.9	%	0.10
Petroleum Hydrocarbon	192	mg/kg	41.2

WESTON
MANAGERS DESIGNERS/CONSULTANTS

WESTON-GULF COAST, INC.
2417 Bor. t., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Friday July 29th, 1994

Project # 02871-005-001-0002
Lab Batch: 9407G302

Inorganic Method Blank Data Report

Sample	Lab ID	Parameter	Result		Units	Reporting Limit
Blank 1	94GTS260-MB1	% Solids	0.10	u	%	0.10
Blank 1	94GIR130-MB1	Petroleum Hydrocarbon	2.6	u	mg/L	2.6

WESTON LF COAST, INC.
2417 Bond St., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Friday July 29th, 1994

Project # 02871-005-001-0002
Lab Batch: 9407G302

Inorganic Precision Data Report

Sample	Site ID	Parameter	Initial Result	Replicate	RPD
-003REP	SWTF-SS-03	Petroleum Hydrocarbons	1730	1470	15.9

WESTON
MANAGERS DESIGNERS/CONSULTANTS

WESTON-GULF COAST, INC.
2417 Bon... ..., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Date: Friday July 29th, 1994

Project # 02871-005-001-0002
Lab Batch: 9407G302

Attn: Mr. Frank Burgess

Inorganic Accuracy Data Report

Sample	Site ID	Parameter	Spiked Sample	Initial Result	Spiked Amount	% Recov
-003	SWTF-SS-03	Petroleum Hydrocarbon	2650	1730	759	122

Roy F. Weston, Inc. - Gulf Coast Laboratories
INORGANIC ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SWTF-SS-01							
SILVER, SERIAL DILUT	001 L	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
SILVER, TOTAL	001	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
SILVER, TOTAL	001 REP	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
SILVER, TOTAL	001 MS	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
ARSENIC, TOTAL	001	S	94GF913	07/18/94	07/20/94	07/22/94	07/26/94
ARSENIC, TOTAL	001 REP	S	94GF913	07/18/94	07/20/94	07/22/94	07/26/94
ARSENIC, TOTAL	001 MS	S	94GF913	07/18/94	07/20/94	07/22/94	07/26/94
BARIUM, SERIAL DILUT	001 L	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
BARIUM, TOTAL	001	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
BARIUM, TOTAL	001 REP	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
BARIUM, TOTAL	001 MS	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CADMIUM, SERIAL DILU	001 L	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CADMIUM, TOTAL	001	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CADMIUM, TOTAL	001 REP	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CADMIUM, TOTAL	001 MS	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CHROMIUM, SERIAL DIL	001 L	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CHROMIUM, TOTAL	001	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CHROMIUM, TOTAL	001 REP	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CHROMIUM, TOTAL	001 MS	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
MERCURY, TOTAL	001	S	94HG396	07/18/94	07/20/94	07/21/94	07/21/94
NICKEL, SERIAL DILUT	001 L	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
NICKEL, TOTAL	001	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
NICKEL, TOTAL	001 REP	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
NICKEL, TOTAL	001 MS	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
LEAD, SERIAL DILUTIO	001 L	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
LEAD, TOTAL	001	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
LEAD, TOTAL	001 REP	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
LEAD, TOTAL	001 MS	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
SELENIUM, TOTAL	001	S	94GF913	07/18/94	07/20/94	07/22/94	07/26/94
SELENIUM, TOTAL	001 REP	S	94GF913	07/18/94	07/20/94	07/22/94	07/27/94
SELENIUM, TOTAL	001 MS	S	94GF913	07/18/94	07/20/94	07/22/94	07/27/94
SWTF-SS-02							
SILVER, TOTAL	002	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
ARSENIC, TOTAL	002	S	94GF913	07/18/94	07/20/94	07/22/94	07/25/94
BARIUM, TOTAL	002	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94

Roy F. Weston, Inc. - Gulf Coast Laboratories
INORGANIC ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
CADMIUM, TOTAL	002	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CHROMIUM, TOTAL	002	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
MERCURY, TOTAL	002	S	94HG396	07/18/94	07/20/94	07/21/94	07/21/94
NICKEL, TOTAL	002	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
LEAD, TOTAL	002	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
SELENIUM, TOTAL	002	S	94GF913	07/18/94	07/20/94	07/22/94	07/27/94
SWTF-SS-03							
SILVER, TOTAL	003	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
ARSENIC, TOTAL	003	S	94GF913	07/18/94	07/20/94	07/22/94	07/25/94
BARIUM, TOTAL	003	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CADMIUM, TOTAL	003	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CHROMIUM, TOTAL	003	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
MERCURY, TOTAL	003	S	94HG396	07/18/94	07/20/94	07/21/94	07/21/94
NICKEL, TOTAL	003	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
LEAD, TOTAL	003	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
SELENIUM, TOTAL	003	S	94GF913	07/18/94	07/20/94	07/22/94	07/28/94
SWTF-SD-01							
SILVER, TOTAL	004	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
ARSENIC, TOTAL	004	S	94GF913	07/18/94	07/20/94	07/22/94	07/25/94
BARIUM, TOTAL	004	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CADMIUM, TOTAL	004	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
CHROMIUM, TOTAL	004	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
MERCURY, TOTAL	004	S	94HG396	07/18/94	07/20/94	07/21/94	07/21/94
NICKEL, TOTAL	004	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
LEAD, TOTAL	004	S	94GI637	07/18/94	07/20/94	07/22/94	07/25/94
SELENIUM, TOTAL	004	S	94GF913	07/18/94	07/20/94	07/22/94	07/27/94
SWTF-Comp-01 TCLP							
SILVER, TCLP LEACHAT	006	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
SILVER, TCLP LEACHAT	006 REP	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
SILVER, TCLP LEACHAT	006 MS	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
ARSENIC, TCLP LEACHA	006	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
ARSENIC, TCLP LEACHA	006 REP	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
ARSENIC, TCLP LEACHA	006 MS	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
BARIUM, TCLP LEACHAT	006	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94

Roy F. Weston, Inc. - Gulf Coast Laboratories
INORGANIC ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
BARIUM, TCLP LEACHAT	006 REP	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
BARIUM, TCLP LEACHAT	006 MS	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
CADMIUM, TCLP LEACHA	006	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
CADMIUM, TCLP LEACHA	006 REP	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
CADMIUM, TCLP LEACHA	006 MS	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
CHROMIUM, TCLP LEACH	006	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
CHROMIUM, TCLP LEACH	006 REP	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
CHROMIUM, TCLP LEACH	006 MS	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
MERCURY, TCLP LEACHA	006	W	94HG406	07/18/94	07/20/94	07/26/94	07/26/94
MERCURY, TCLP LEACHA	006 MS	W	94HG406	07/18/94	07/20/94	07/26/94	07/26/94
NICKEL, TCLP LEACHAT	006	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
NICKEL, TCLP LEACHAT	006 REP	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
NICKEL, TCLP LEACHAT	006 MS	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
LEAD, TCLP LEACHATE	006	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
LEAD, TCLP LEACHATE	006 REP	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
LEAD, TCLP LEACHATE	006 MS	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
SELENIUM, TCLP LEACH	006	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
SELENIUM, TCLP LEACH	006 REP	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
SELENIUM, TCLP LEACH	006 MS	W	94GE500	07/18/94	07/20/94	07/26/94	07/27/94
SWTF-W-01							
SILVER, TOTAL	008	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
ARSENIC, TOTAL	008	W	94GF912	07/18/94	07/20/94	07/21/94	07/24/94
ARSENIC, TOTAL	008 REP	W	94GF912	07/18/94	07/20/94	07/21/94	07/24/94
ARSENIC, TOTAL	008 MS	W	94GF912	07/18/94	07/20/94	07/21/94	07/24/94
BARIUM, TOTAL	008	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
CADMIUM, TOTAL	008	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
CHROMIUM, TOTAL	008	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
MERCURY, TOTAL	008	W	94HG397	07/18/94	07/20/94	07/21/94	07/21/94
NICKEL, TOTAL	008	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
LEAD, TOTAL	008	W	94GF912	07/18/94	07/20/94	07/21/94	07/26/94
LEAD, TOTAL	008 REP	W	94GF912	07/18/94	07/20/94	07/21/94	07/22/94
LEAD, TOTAL	008 MS	W	94GF912	07/18/94	07/20/94	07/21/94	07/22/94
SELENIUM, TOTAL	008	W	94GF912	07/18/94	07/20/94	07/21/94	07/21/94
SELENIUM, TOTAL	008 REP	W	94GF912	07/18/94	07/20/94	07/21/94	07/21/94
SELENIUM, TOTAL	008 MS	W	94GF912	07/18/94	07/20/94	07/21/94	07/21/94

NY CERTIFICATION # 11006

Roy F. Weston, Inc. - Gulf Coast Laboratories
INORGANIC ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SWTF-W-02							
SILVER, TOTAL	009	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
ARSENIC, TOTAL	009	W	94GF912	07/18/94	07/20/94	07/21/94	07/24/94
BARIUM, TOTAL	009	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
CADMIUM, TOTAL	009	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
CHROMIUM, TOTAL	009	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
MERCURY, TOTAL	009	W	94HG397	07/18/94	07/20/94	07/21/94	07/21/94
NICKEL, TOTAL	009	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
LEAD, TOTAL	009	W	94GF912	07/18/94	07/20/94	07/21/94	07/22/94
SELENIUM, TOTAL	009	W	94GF912	07/18/94	07/20/94	07/21/94	07/21/94
SWTF-WU-01							
SILVER, TOTAL	010	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
ARSENIC, TOTAL	010	W	94GF912	07/18/94	07/20/94	07/21/94	07/24/94
BARIUM, TOTAL	010	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
CADMIUM, TOTAL	010	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
CHROMIUM, TOTAL	010	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
MERCURY, TOTAL	010	W	94HG397	07/18/94	07/20/94	07/21/94	07/21/94
NICKEL, TOTAL	010	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
LEAD, TOTAL	010	W	94GF912	07/18/94	07/20/94	07/21/94	07/22/94
SELENIUM, TOTAL	010	W	94GF912	07/18/94	07/20/94	07/21/94	07/21/94
SWTF-WD-01							
SILVER, TOTAL	011	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
ARSENIC, TOTAL	011	W	94GF912	07/18/94	07/20/94	07/21/94	07/24/94
BARIUM, TOTAL	011	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
CADMIUM, TOTAL	011	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
CHROMIUM, TOTAL	011	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
MERCURY, TOTAL	011	W	94HG402	07/18/94	07/20/94	07/22/94	07/22/94
NICKEL, TOTAL	011	W	94GI633	07/18/94	07/20/94	07/21/94	07/22/94
LEAD, TOTAL	011	W	94GF912	07/18/94	07/20/94	07/21/94	07/22/94
SELENIUM, TOTAL	011	W	94GF912	07/18/94	07/20/94	07/21/94	07/21/94

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City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
LAB QC:							
SILVER LABORATORY	LC1 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
BARIUM LABORATORY	LC1 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
CADMIUM LABORATORY	LC1 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
CHROMIUM LABORATORY	LC1 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
NICKEL LABORATORY	LC1 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
LEAD LABORATORY	LC1 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
SILVER LABORATORY	LC2 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
BARIUM LABORATORY	LC2 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
CADMIUM LABORATORY	LC2 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
CHROMIUM LABORATORY	LC2 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
NICKEL LABORATORY	LC2 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
LEAD LABORATORY	LC2 BS	S	94GI637	N/A	N/A	07/22/94	07/25/94
SILVER, TOTAL	MB1	S	94GI637	N/A	N/A	07/22/94	07/25/94
BARIUM, TOTAL	MB1	S	94GI637	N/A	N/A	07/22/94	07/25/94
CADMIUM, TOTAL	MB1	S	94GI637	N/A	N/A	07/22/94	07/25/94
CHROMIUM, TOTAL	MB1	S	94GI637	N/A	N/A	07/22/94	07/25/94
NICKEL, TOTAL	MB1	S	94GI637	N/A	N/A	07/22/94	07/25/94
LEAD, TOTAL	MB1	S	94GI637	N/A	N/A	07/22/94	07/25/94
ARSENIC LABORATORY	LC1 BS	S	94GF913	N/A	N/A	07/22/94	07/25/94
SELENIUM LABORATORY	LC1 BS	S	94GF913	N/A	N/A	07/22/94	07/27/94
ARSENIC LABORATORY	LC2 BS	S	94GF913	N/A	N/A	07/22/94	07/25/94
SELENIUM LABORATORY	LC2 BS	S	94GF913	N/A	N/A	07/22/94	07/26/94
ARSENIC, TOTAL	MB1	S	94GF913	N/A	N/A	07/22/94	07/25/94
SELENIUM, TOTAL	MB1	S	94GF913	N/A	N/A	07/22/94	07/26/94
MERCURY LABORATORY	LC1 BS	S	94HG396	N/A	N/A	07/21/94	07/21/94
MERCURY LABORATORY	LC2 BS	S	94HG396	N/A	N/A	07/21/94	07/21/94
MERCURY, TOTAL	MB1	S	94HG396	N/A	N/A	07/21/94	07/21/94
SILVER LABORATORY	LC1 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
ARSENIC LABORATORY	LC1 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
BARIUM LABORATORY	LC1 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
CADMIUM LABORATORY	LC1 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
CHROMIUM LABORATORY	LC1 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
NICKEL LABORATORY	LC1 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
LEAD LABORATORY	LC1 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94

Roy F. Weston, Inc. - Gulf Coast Laboratories
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City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SELENIUM LABORATORY	LC1 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
SILVER LABORATORY	LC2 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
ARSENIC LABORATORY	LC2 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
BARIUM LABORATORY	LC2 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
CADMIUM LABORATORY	LC2 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
CHROMIUM LABORATORY	LC2 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
NICKEL LABORATORY	LC2 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
LEAD LABORATORY	LC2 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
SELENIUM LABORATORY	LC2 BS	W	94GE500	N/A	N/A	07/26/94	07/27/94
SILVER, TCLP LEACHAT	MB1	W	94GE500	N/A	N/A	07/26/94	07/27/94
ARSENIC, TCLP LEACHA	MB1	W	94GE500	N/A	N/A	07/26/94	07/27/94
BARIUM, TCLP LEACHAT	MB1	W	94GE500	N/A	N/A	07/26/94	07/27/94
CADMIUM, TCLP LEACHA	MB1	W	94GE500	N/A	N/A	07/26/94	07/27/94
CHROMIUM, TCLP LEACH	MB1	W	94GE500	N/A	N/A	07/26/94	07/27/94
NICKEL, TCLP LEACHAT	MB1	W	94GE500	N/A	N/A	07/26/94	07/27/94
LEAD, TCLP LEACHATE	MB1	W	94GE500	N/A	N/A	07/26/94	07/27/94
SELENIUM, TCLP LEACH	MB1	W	94GE500	N/A	N/A	07/26/94	07/27/94
SILVER, TCLP LEACHAT	MB2	W	94GE500	N/A	N/A	07/26/94	07/27/94
ARSENIC, TCLP LEACHA	MB2	W	94GE500	N/A	N/A	07/26/94	07/27/94
BARIUM, TCLP LEACHAT	MB2	W	94GE500	N/A	N/A	07/26/94	07/27/94
CADMIUM, TCLP LEACHA	MB2	W	94GE500	N/A	N/A	07/26/94	07/27/94
CHROMIUM, TCLP LEACH	MB2	W	94GE500	N/A	N/A	07/26/94	07/27/94
NICKEL, TCLP LEACHAT	MB2	W	94GE500	N/A	N/A	07/26/94	07/27/94
LEAD, TCLP LEACHATE	MB2	W	94GE500	N/A	N/A	07/26/94	07/27/94
SELENIUM, TCLP LEACH	MB2	W	94GE500	N/A	N/A	07/26/94	07/27/94
MERCURY LABORATORY	LC1 BS	W	94HG406	N/A	N/A	07/26/94	07/26/94
MERCURY LABORATORY	LC2 BS	W	94HG406	N/A	N/A	07/26/94	07/26/94
MERCURY, TOTAL	MB1	W	94HG406	N/A	N/A	07/26/94	07/26/94
MERCURY, TCLP LEACHA	MB2	W	94HG406	N/A	N/A	07/26/94	07/26/94
MERCURY, TCLP LEACHA	MB3	W	94HG406	N/A	N/A	07/26/94	07/26/94
SILVER LABORATORY	LC1 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
BARIUM LABORATORY	LC1 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
CADMIUM LABORATORY	LC1 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
CHROMIUM LABORATORY	LC1 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
NICKEL LABORATORY	LC1 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
SILVER LABORATORY	LC2 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
BARIUM LABORATORY	LC2 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
CADMIUM LABORATORY	LC2 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
CHROMIUM LABORATORY	LC2 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94
NICKEL LABORATORY	LC2 BS	W	94GI633	N/A	N/A	07/21/94	07/22/94

WESTON MANAGERS DESIGNERS CONSULTANTS

Roy F. Weston, Inc. - Gulf Coast Laboratories
INORGANIC ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SILVER, TOTAL	MB1	W	94GI633	N/A	N/A	07/21/94	07/22/94
BARIUM, TOTAL	MB1	W	94GI633	N/A	N/A	07/21/94	07/22/94
CADMIUM, TOTAL	MB1	W	94GI633	N/A	N/A	07/21/94	07/22/94
CHROMIUM, TOTAL	MB1	W	94GI633	N/A	N/A	07/21/94	07/22/94
NICKEL, TOTAL	MB1	W	94GI633	N/A	N/A	07/21/94	07/22/94
ARSENIC LABORATORY	LC1 BS	W	94GF912	N/A	N/A	07/21/94	07/24/94
LEAD LABORATORY	LC1 BS	W	94GF912	N/A	N/A	07/21/94	07/22/94
SELENIUM LABORATORY	LC1 BS	W	94GF912	N/A	N/A	07/21/94	07/21/94
ARSENIC LABORATORY	LC2 BS	W	94GF912	N/A	N/A	07/21/94	07/24/94
LEAD LABORATORY	LC2 BS	W	94GF912	N/A	N/A	07/21/94	07/26/94
SELENIUM LABORATORY	LC2 BS	W	94GF912	N/A	N/A	07/21/94	07/21/94
ARSENIC, TOTAL	MB1	W	94GF912	N/A	N/A	07/21/94	07/24/94
LEAD, TOTAL	MB1	W	94GF912	N/A	N/A	07/21/94	07/22/94
SELENIUM, TOTAL	MB1	W	94GF912	N/A	N/A	07/21/94	07/21/94
MERCURY LABORATORY	LC1 BS	W	94HG397	N/A	N/A	07/21/94	07/21/94
MERCURY LABORATORY	LC2 BS	W	94HG397	N/A	N/A	07/21/94	07/21/94
MERCURY, TOTAL	MB1	W	94HG397	N/A	N/A	07/21/94	07/21/94
MERCURY LABORATORY	LC1 BS	W	94HG402	N/A	N/A	07/22/94	07/22/94
MERCURY LABORATORY	LC2 BS	W	94HG402	N/A	N/A	07/22/94	07/22/94
MERCURY, TOTAL	MB1	W	94HG402	N/A	N/A	07/22/94	07/22/94

SIGNATURE [illegible] DATE 8/3/94

NY CERTIFICATION # 11006

WESTON MANAGERS DESIGNERS/CONSULTANTS

WESTON .F COAST, INC.
2417 Bond St., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: SWTF-SS-01
Project # 02871-005-001-0002
Lab ID: 9407G302-001
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result	Units	Reporting Limit
Silver, Total	48.5	mg/kg	0.98
Arsenic, Total	1.1	mg/kg	0.79
Barium, Total	398	mg/kg	4.9
Cadmium, Total	5.1	mg/kg	0.98
Chromium, Total	569	mg/kg	2.0
Mercury, Total	13.9	mg/kg	0.88
Nickel, Total	159	mg/kg	2.0
Lead, Total	215	mg/kg	4.9
Selenium, Total	2.0	mg/kg	0.20

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: **SWTF-SS-02**
Project # 02871-005-001-0002
Lab ID: **9407G302-002**
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result		Units	Reporting Limit
Silver, Total	0.91	u	mg/kg	0.91
Arsenic, Total	2.3		mg/kg	0.92
Barium, Total	42.9		mg/kg	4.5
Cadmium, Total	0.91	u	mg/kg	0.91
Chromium, Total	10.7		mg/kg	1.8
Mercury, Total	0.080		mg/kg	0.079
Nickel, Total	3.6		mg/kg	1.8
Lead, Total	10		mg/kg	4.5
Selenium, Total	1.3		mg/kg	0.92

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: **SWTF-SD-01**
Project # 02871-005-001-0002
Lab ID: **9407G302-004**
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result		Units	Reporting Limit
Silver, Total	1.4	u	mg/kg	1.4
Arsenic, Total	0.98		mg/kg	0.27
Barium, Total	43.4		mg/kg	7.0
Cadmium, Total	1.4	u	mg/kg	1.4
Chromium, Total	10.9		mg/kg	2.8
Mercury, Total	0.16		mg/kg	0.12
Nickel, Total	5.0		mg/kg	2.8
Lead, Total	11.3		mg/kg	7.0
Selenium, Total	0.33		mg/kg	0.27

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: **SWTF-Comp-01 TCLP**
Project # 02871-005-001-0002
Lab ID: **9407G302-006**
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result		Units	Reporting Limit
Silver, TCLP Leachate	0.050	u	mg/L	0.050
Arsenic, TCLP Leachat	0.10	u	mg/L	0.10
Barium, TCLP Leachate	0.50	u	mg/L	0.50
Cadmium, TCLP Leachat	0.050	u	mg/L	0.050
Chromium, TCLP Leacha	0.050	u	mg/L	0.050
Mercury, TCLP Leachat	0.010	u	mg/L	0.010
Nickel, TCLP Leachate	0.16		mg/L	0.050
Lead, TCLP Leachate	0.050	u	mg/L	0.050
Selenium, TCLP Leacha	0.10	u	mg/L	0.10

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Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: **SWTF-W-01**
Project # 02871-005-001-0002
Lab ID: **9407G302-008**
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result		Units	Reporting Limit
Silver, Total	0.010	u	mg/L	0.010
Arsenic, Total	0.0020	u	mg/L	0.0020
Barium, Total	0.056		mg/L	0.050
Cadmium, Total	0.010	u	mg/L	0.010
Chromium, Total	0.020	u	mg/L	0.020
Mercury, Total	0.00020	u	mg/L	0.00020
Nickel, Total	0.020	u	mg/L	0.020
Lead, Total	0.014		mg/L	0.0040
Selenium, Total	0.0020	u	mg/L	0.0020

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: **SWTF-W-02**
Project # 02871-005-001-0002
Lab ID: **9407G302-009**
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result		Units	Reporting Limit
Silver, Total	0.010	u	mg/L	0.010
Arsenic, Total	0.0020	u	mg/L	0.0020
Barium, Total	0.050	u	mg/L	0.050
Cadmium, Total	0.010	u	mg/L	0.010
Chromium, Total	0.020	u	mg/L	0.020
Mercury, Total	0.018		mg/L	0.0020
Nickel, Total	0.020	u	mg/L	0.020
Lead, Total	0.0048		mg/L	0.0020
Selenium, Total	0.0020	u	mg/L	0.0020

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: SWTF-WU-01
Project # 02871-005-001-0002
Lab ID: 9407G302-010
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result	Units	Reporting Limit
Silver, Total	0.010 u	mg/L	0.010
Arsenic, Total	0.0020 u	mg/L	0.0020
Barium, Total	0.053	mg/L	0.050
Cadmium, Total	0.010 u	mg/L	0.010
Chromium, Total	0.020 u	mg/L	0.020
Mercury, Total	0.00020 u	mg/L	0.00020
Nickel, Total	0.020 u	mg/L	0.020
Lead, Total	0.0073	mg/L	0.0020
Selenium, Total	0.0020 u	mg/L	0.0020

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Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: SWTF-WD-01
Project # 02871-005-001-0002
Lab ID: 9407G302-011
Sample Date: 07/18/94
Date Received: 07/20/94

Inorganic Data Report

Parameters	Result	Units	Reporting Limit
Silver, Total	0.010 u	mg/L	0.010
Arsenic, Total	0.0020 u	mg/L	0.0020
Barium, Total	0.051	mg/L	0.050
Cadmium, Total	0.010 u	mg/L	0.010
Chromium, Total	0.020 u	mg/L	0.020
Mercury, Total	0.00020 u	mg/L	0.00020
Nickel, Total	0.020 u	mg/L	0.020
Lead, Total	0.0064	mg/L	0.0020
Selenium, Total	0.0020 u	mg/L	0.0020

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

Project # 02871-005-001-0002
Lab Batch: 9407G302

Inorganic Method Blank Data Report

Sample	Lab ID	Parameter	Result		Units	Reporting Limit
Blank 1	94GI637-MB1	Silver, Total	1.0	u	mg/kg	1.0
		Barium, Total	5.0	u	mg/kg	5.0
		Cadmium, Total	1.0	u	mg/kg	1.0
		Chromium, Total	2.0	u	mg/kg	2.0
		Nickel, Total	2.0	u	mg/kg	2.0
		Lead, Total	5.0	u	mg/kg	5.0
Blank 1	94GF913-MB1	Arsenic, Total	0.20	u	mg/kg	0.20
		Selenium, Total	0.20	u	mg/kg	0.20
Blank 1	94HG396-MB1	Mercury, Total	0.10	u	mg/kg	0.10
Blank 1	94GE500-MB1	Silver, TCLP Leachate	0.050	u	mg/L	0.050
		Arsenic, TCLP Leachat	0.10	u	mg/L	0.10
		Barium, TCLP Leachate	0.50	u	mg/L	0.50
		Cadmium, TCLP Leachat	0.050	u	mg/L	0.050
		Chromium, TCLP Leacha	0.050	u	mg/L	0.050
		Nickel, TCLP Leachate	0.050	u	mg/L	0.050
		Lead, TCLP Leachate	0.050	u	mg/L	0.050
		Selenium, TCLP Leacha	0.10	u	mg/L	0.10

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ANALYTICAL REPORT

To: City Of Auburn
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Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

Project # 02871-005-001-0002
Lab Batch: 9407G302

Inorganic Method Blank Data Report

Sample	Lab ID	Parameter	Result		Units	Reporting Limit
Blank 2	94GE500-MB2	Silver, TCLP Leachate	0.050	u	mg/L	0.050
		Arsenic, TCLP Leachat	0.10	u	mg/L	0.10
		Barium, TCLP Leachate	0.50	u	mg/L	0.50
		Cadmium, TCLP Leachat	0.050	u	mg/L	0.050
		Chromium, TCLP Leacha	0.050	u	mg/L	0.050
		Nickel, TCLP Leachate	0.050	u	mg/L	0.050
		Lead, TCLP Leachate	0.050	u	mg/L	0.050
		Selenium, TCLP Leacha	0.10	u	mg/L	0.10
Blank 1	94HG406-MB1	Mercury, Total	0.00020	u	mg/L	0.00020
Blank 2	94HG406-MB2	Mercury, TCLP Leachat	0.010	u	mg/L	0.010
Blank 3	94HG406-MB3	Mercury, TCLP Leachat	0.010	u	mg/L	0.010
Blank 1	94GI633-MB1	Silver, Total	0.010	u	mg/L	0.010
		Barium, Total	0.050	u	mg/L	0.050
		Cadmium, Total	0.010	u	mg/L	0.010
		Chromium, Total	0.020	u	mg/L	0.020
		Nickel, Total	0.020	u	mg/L	0.020
Blank 1	94GF912-MB1	Arsenic, Total	0.0020	u	mg/L	0.0020

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

Project # 02871-005-001-0002
Lab Batch: **9407G302**

Inorganic Method Blank Data Report

Sample	Lab ID	Parameter	Result	Units	Reporting Limit
Blank 1	94GF912-MB1	Lead, Total	0.0020 u	mg/L	0.0020
		Selenium, Total	0.0020 u	mg/L	0.0020
Blank 1	94HG397-MB1	Mercury, Total	0.00020 u	mg/L	0.00020
Blank 1	94HG402-MB1	Mercury, Total	0.00020 u	mg/L	0.00020

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WESTON MANAGERS DESIGNERS/CONSULTANTS

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

Project # 02871-005-001-0002
Lab Batch: 9407G302

Inorganic Precision Data Report

Sample	Site ID	Parameter	Initial Result		Replicate		RPD
-001REP	SWTF-SS-01	Silver, Total	48.5		51.7		6.5
		Arsenic, Total	1.1		1.5		32.0
		Barium, Total	398		454		13.0
		Cadmium, Total	5.1		5.6		8.6
		Chromium, Total	569		617		8.2
		Nickel, Total	159		176		10.1
		Lead, Total	215		228		6.1
		Selenium, Total	2.0		3.5		54.4
-006REP	SWTF-Comp-01 TCLP	Silver, Leachate	0.050	u	0.050	u	NC
		Arsenic, Leachate	0.10	u	0.10	u	NC
		Barium, Leachate	0.50	u	0.50	u	NC
		Cadmium, Leachate	0.050	u	0.050	u	NC
		Chromium, Leachate	0.050	u	0.050	u	NC
		Nickel, Leachate	0.16		0.15		9.5
		Lead, Leachate	0.050	u	0.050	u	NC
		Selenium, TCLP Leachate	0.10	u	0.10	u	NC
-008REP	SWTF-W-01	Arsenic, Total	0.0020	u	0.0020	u	NC

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2417 Bond St., University Park, I
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ANALYTICAL REPORT

994

002

To: **City Of Auburn**
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: **Mr. Frank Burgess**

Date: Wednesday August 3

Project # 02871-005-(
Lab Batch: **9407G302**

piked mount	% Recov
5.0	NA
4.0	87.9
99	103
5.0	91.4
19.9	NA
49.6	92.6
49.6	NA
0.99	219
1.0	92.3
5.0	95.7
0	94.2
1.0	90.9
5.0	91.2
0.20	89.8
0.50	88.9
5.0	89.9
1.0	103

Inorganic Accuracy Data Report

Sample	Site ID	Parameter	Spiked Sample	Initial Result
-008	SWTF-W-01	Arsenic, Total	0.037	0.0020
		Lead, Total	0.028	0.014
		Selenium, Total	0.0096	0.0020

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

Project # 02871-005-001-0002
Lab Batch: 9407G302

Inorganic Laboratory Control Standards Report

Lab ID	Parameter	Spiked Amount	Units	Spike #1 % Recov.	Spike #2 % Recov.	RPD
94GI637-LC1	Silver, LCS	5.0	mg/kg	91.3	88.5	3.1
	Barium, LCS	200	mg/kg	104	103	1.0
	Cadmium, LCS	5.0	mg/kg	95.1	98.0	3.0
	Chromium, LCS	20.0	mg/kg	104	102	2.0
	Nickel, LCS	50.0	mg/kg	101	99.6	1.0
	Lead, LCS	50.0	mg/kg	95.2	90.5	5.1
94GF913-LC1	Arsenic, LCS	4.0	mg/kg	95.7	94.7	1.0
	Selenium, LCS	1.0	mg/kg	108	86.1	22.6
94HG396-LC1	Mercury, LCS	1.0	mg/kg	99.4	103	3.8
94GE500-LC1	Silver, LCS	0.050	mg/L	99.5	100	0.76
	Arsenic, LCS	2.0	mg/L	100	98.8	1.5
	Barium, LCS	2.0	mg/L	101	100	1.2
	Cadmium, LCS	0.050	mg/L	97.5	99.4	1.9
	Chromium, LCS	0.20	mg/L	106	105	1.3
	Nickel, LCS	0.50	mg/L	101	97.6	3.6
	Lead, LCS	0.50	mg/L	97.4	94.9	2.6
	Selenium, LCS	2.0	mg/L	100	99.2	0.85

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ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Date: Wednesday August 3rd, 1994

Project # 02871-005-001-0002
Lab Batch: 9407G302

Attn: Mr. Frank Burgess

Inorganic Laboratory Control Standards Report

Lab ID	Parameter	Spiked Amount	Units	Spike #1 % Recov.	Spike #2 % Recov.	RPD
94HG406-LC1	Mercury, LCS	0.0020	mg/L	99.2	102	3.1
94GI633-LC1	Silver, LCS	0.050	mg/L	106	106	0.74
	Barium, LCS	2.0	mg/L	104	104	0.50
	Cadmium, LCS	0.050	mg/L	106	103	2.5
	Chromium, LCS	0.20	mg/L	109	109	0.0046
	Nickel, LCS	0.50	mg/L	104	103	1.4
94GF912-LC1	Arsenic, LCS	0.040	mg/L	84.5	89.7	6.0
	Lead, LCS	0.020	mg/L	119	105	12.6
	Selenium, LCS	0.010	mg/L	95.1	97.1	2.1
94HG397-LC1	Mercury, LCS	0.0020	mg/L	97.9	99.5	1.6
94HG402-LC1	Mercury, LCS	0.0020	mg/L	100	99.6	0.75

WESTON-GULF COAST, INC.
TCLP EXTRACTION

OP No. 21-15G-1526

RFW #	9407G-302-006	9407G-290-002	004	006	008
RFW # Used for Bias Correction	302-006	NA			
Group #	T-356 M,B,P,H	T-356 M			
Sample Description	Soil				
Sample Weight (g)	100				
Liquid-Solid Separation (Yes/No)	No				
Volume of Mother Liquid (mls)	NA				
Solid Extraction Material (g)	100				
Sample Size Specifications	<9.5mm				
Extraction Fluid Selection pH of Initial Solution If <5.0 use Extraction Fluid #1	7.67	8.90	8.80	8.78	8.76
pH of Acid/Heat Treated Soln. If <5.0 use Extraction Fluid #1 If >5.0 use Extraction Fluid #2	1.62	1.85	3.02	2.25	2.35
Extraction Fluid Type (1 or 2)	1	1	1	1	1
Extr. Vessel Type/Pressure Check	T	HDPE			
Extraction Fluid Volume (mls)	2000				
Extract Filtered (Yes or No)	yes				
Mother Liquid Added (mls)	NA				
Combined Filtrate Volume (mls)	2000				
Final pH Reading	5.42	5.56	5.57	5.82	5.85
Spike Solution Added (mls)	[illegible] + 2ml	NA			
Spike Source ID #	634, 635	NA			
Filtrate Preserved	yes for M				
Start Date/Time	7-25-94 12:10P				
Start Temperature °C	22.0				
End Date/Time	7-26-94 Timer 6:10A				
End Temperature °C	21.0 [illegible] 9:30A				

Extraction Vessel Codes: T = Teflon; Organics/Metals ZHE = Zero Headspace; VOA's HDPE = High Density Polyethylene Metals

Analyst: [illegible] Date: 7-26-94

Reviewer: [illegible] Date: 7/26/94

Roy F. Weston, Inc. - Gulf Coast Laboratories
602 ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SWTF-W-01	008	W	94GVD368	07/18/94	07/20/94	N/A	07/26/94
SWTF-W-02	009	W	94GVD368	07/18/94	07/20/94	N/A	07/26/94
SWTF-WU-01	010	W	94GVD368	07/18/94	07/20/94	N/A	07/26/94
SWTF-WD-01	011	W	94GVD368	07/18/94	07/20/94	N/A	07/27/94
SWTF-WD-01	011 MS	W	94GVD368	07/18/94	07/20/94	N/A	07/27/94
SWTF-WD-01	011 MSD	W	94GVD368	07/18/94	07/20/94	N/A	07/27/94
LAB QC:							
TBLKBZ	MB1	W	94GVD368	N/A	N/A	N/A	07/26/94
TBLKBZ	MB1 BS	W	94GVD368	N/A	N/A	N/A	07/26/94
TBLKBZ	MB1 BSD	W	94GVD368	N/A	N/A	N/A	07/26/94

SIGNATURE Linda S Mackley DATE 8-2-94

NY CERTIFICATION # 11006

WESTON-G E COAST, INC.
2417 Bond St., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Tuesday August 2nd, 1994

RE: SWTF-W-02
Project # 02871-005-001-0002
Lab ID: 9407G302-009
Sample Date: 07/18/94
Date Received: 07/20/94
Units: UG/L

PURGEABLE AROMATICS BY GC

Compound	Result	Reporting Limit	Flag
Benzene	BRL	0.80	U
Toluene	BRL	0.80	U
Ethylbenzene	BRL	0.80	U
Xylene (total)	BRL	0.80	U

WESTON MANAGERS DESIGNERS/CONSULTANTS

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Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Tuesday August 2nd, 1994

RE: **SWTF-WU-01**
Project # 02871-005-001-0002
Lab ID: **9407G302-010**
Sample Date: 07/18/94
Date Received: 07/20/94
Units: UG/L

PURGEABLE AROMATICS BY GC

Compound	Result	Reporting Limit	Flag
Benzene	BRL	0.80	U
Toluene	BRL	0.80	U
Ethylbenzene	BRL	0.80	U
Xylene (total)	BRL	0.80	U

Sample Information	Cust ID:	SWTF-W-01		SWTF-W-02		SWTF-WU-01		SWTF-WD-01		SWTF-WD-01		SWTF-WD-01	
	RFW#:	008		009		010		011		011 MS		011 MSD	
	Matrix:	WATER		WATER		WATER		WATER		WATER		WATER	
	D.F.:	1.0		1.0		1.0		1.0		1.0		1.0	
	Units:	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
a,a,a-Trifluorotoluene		96	%	98	%	90	%	90	%	92	%	87	%
			fl		fl		fl		fl		fl		fl
Benzene		0.80	U	0.80	U	0.80	U	0.80	U	91	%	88	%
Toluene		0.80	U	0.80	U	0.80	U	0.80	U	90	%	87	%
Ethylbenzene		0.80	U	0.80	U	0.80	U	0.80	U	86	%	84	%
Xylene (total)		0.80	U	0.80	U	0.80	U	0.80	U	0.80	U	0.80	U

Sample Information	Cust ID:	TBLKBZ		TBLKBZ BS		TBLKBZ BSD	
	RFW#:	94GVD368-MB1		94GVD368-MB1		94GVD368-MB1	
	Matrix:	WATER		WATER		WATER	
	D.F.:	1.0		1.0		1.0	
	Units:	ug/L		ug/L		ug/L	
a,a,a-Trifluorotoluene		92	%	99	%	95	%
			fl		fl		fl
Benzene		0.80	U	93	%	95	%
Toluene		0.80	U	93	%	94	%
Ethylbenzene		0.80	U	92	%	93	%
Xylene (total)		0.80	U	0.80	U	0.80	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

WESTON

Roy F. Weston, Inc. - Gulf Coast Laboratories
PEST/PCB ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SWTF-Comp-01 TCLP	006	W	94GP0589	07/18/94	07/20/94	07/27/94	07/28/94
SWTF-Comp-01 TCLP	006 MS	W	94GP0589	07/18/94	07/20/94	07/27/94	07/28/94
LAB QC:							
PBLKEC	MB1	W	94GP0589	N/A	N/A	07/27/94	07/28/94
PBLKED	TC1	W	94GP0589	N/A	N/A	07/27/94	07/28/94

SIGNATURE Linda S. Mackley DATE 8-3-94

NY CERTIFICATION # 11006

WESTON
MANAGERS DESIGNERS/CONSULTANTS

WESTON-GULF COAST, INC.
2417 Bond St., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: SWTF-Comp-01 TCLP
Project # 02871-005-001-0002
Lab ID: 9407G302-006
Sample Date: 07/18/94
Date Received: 07/20/94
Units: UG/L

PESTICIDES BY GC, TCLP LEACHATE

Compound	Result	Reporting Limit	Flag
gamma-BHC (Lindane)	BRL	0.50	U
Heptachlor	BRL	0.60	U
Heptachlor epoxide	BRL	0.80	U
Chlordane	BRL	1.0	U
Endrin	BRL	3.0	U
Methoxychlor	BRL	7.0	U
Toxaphene	BRL	50	U

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDES BY GC, TCLP LEACHATE

Report Date: 08/03/94 08:36

RFW Batch Number: 9407G302 Client: City Of Auburn Work Order: 02871-005-001-0 Page: 1

	Cust ID:	SWTF-Comp-01 TCLP		SWTF-Comp-01 TCLP		PBLKEC		PBLKED	
Sample Information	RFW#:	006		006 MS		94GP0589-MB1		94GP0589-TC1	
	Matrix:	WATER		WATER		WATER		WATER	
	D.F.:	10.0		10.0		10.0		10.0	
	Units:	ug/L		ug/L		ug/L		ug/L	
Surrogate: Di-n-butylchlorendate		104	%	104	%	98	%	106	%
			fl		fl		fl		fl
gamma-BHC (Lindane)		0.50	U	110	%	0.050	U	0.50	U
Heptachlor		0.60	U	76	%	0.060	U	0.60	U
Heptachlor epoxide		0.80	U	100	%	0.080	U	0.80	U
Chlordane		1.0	U	103	%	0.10	U	1.0	U
Endrin		3.0	U	107	%	0.30	U	3.0	U
Methoxychlor		7.0	U	101	%	0.70	U	7.0	U
Toxaphene		50	U	87	%	5.0	U	50	U

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%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Gulf Coast Laboratories
HBGT ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SWTF-Comp-01 TCLP	006	W	94GP0612	07/18/94	07/20/94	08/04/94	08/09/94
SWTF-Comp-01 TCLP	006 MS	W	94GP0612	07/18/94	07/20/94	08/04/94	08/09/94
LAB QC:							
PBLKFA	MB1	W	94GP0612	N/A	N/A	08/04/94	08/09/94
PBLKFB	TC1	W	94GP0612	N/A	N/A	08/04/94	08/09/94
PBLKFC	TC2	W	94GP0612	N/A	N/A	08/04/94	08/09/94

SIGNATURE Brenda J. Kenyon DATE 8-10-94

NY CERTIFICATION # 11006

WESTON MANAGERS DESIGNERS/CONSULTANTS

CASE NARRATIVE
Organics

Weston-Gulf Coast
City of Auburn
RFW# 9407G302-006
TCLP Herbicides

1. Weston - Gulf Coast used the following Gas Chromatographic systems for analysis of herbicides:

ID#	INSTRUMENT	COLUMN TYPE	DETECTOR
08	Varian 3700	4%SE30/6%SP2401	Electron Capture

2. This TCLP extract was analyzed for herbicides based on SW846 method 8150.

3. This sample was initially extracted within hold time; however, upon analysis it was discovered that the wrong surrogate compound was used. The sample was re-extracted 2 days past its hold time with the correct surrogate compound.

4. The method blanks were below the reporting limits for all analytes.

5. All surrogate recoveries were within control limits.

6. A matrix spike was performed on this sample. All spike recoveries associated with this sample were within control limits.

7. All initial and continuing standard calibrations associated with this sample were within control limits.

Brenda J. Thompson
Unit Leader GC Extractables

8-10-94
Date

WESTON MANAGERS DESIGNERS/CONSULTANTS

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2417 Bon ., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 10th, 1994

RE: **SWTF-Comp-01 TCLP**
Project # 02871-005-001-0002
Lab ID: **9407G302-006**
Sample Date: 07/18/94
Date Received: 07/20/94
Units: UG/L

HERBICIDES BY GC, TCLP LEACHATE

Compound	Result	Reporting Limit	Flag
2,4,5-TP	BRL	2.0	U
2,4-D	BRL	20	U

Sample Information		SWTF-Comp-01 TCLP		SWTF-Comp-01 TCLP		PBLKFA		PBLKFB		PBLKFC	
	Cust ID:	SWTF-Comp-01 TCLP		SWTF-Comp-01 TCLP		PBLKFA		PBLKFB		PBLKFC	
	RFW#:	006		006 MS		94GP0612-MB1		94GP0612-TC1		94GP0612-TC2	
	Matrix:	WATER		WATER		WATER		WATER		WATER	
	D.F.:	100		100		100		100		100	
	Units:	ug/L		ug/L		ug/L		ug/L		ug/L	
Surrogate:	2,4-DB	97	%	94	%	97	%	99	%	101	%
			fl		fl		fl		fl		fl
2,4,5-TP		2.0	U	104	%	0.20	U	2.0	U	2.0	U
2,4-D		20	U	114	%	2.0	U	20	U	20	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

WESTON MANAGERS DESIGNERS/CONSULTANTS

Roy F. Weston, Inc. - Gulf Coast Laboratories
VOA ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SWTF-Comp-01 TCLV	007	W	94GVC262	07/18/94	07/20/94	N/A	07/31/94
SWTF-Comp-01 TCLV	007 MS	W	94GVC263	07/18/94	07/20/94	N/A	08/02/94

LAB QC:

CLIENT ID	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
VBLK	358	W	94GVC262	N/A	N/A	N/A	07/31/94
VBLK	MB1	W	94GVC262	N/A	N/A	N/A	07/31/94
VBLK	MB1	W	94GVC263	N/A	N/A	N/A	08/01/94
VBLK	MB1 BS	W	94GVC263	N/A	N/A	N/A	08/01/94
VBLK	MB1 BSD	W	94GVC263	N/A	N/A	N/A	08/02/94

SIGNATURE Jeff A. Kazinsh DATE 8-3-94

NY CERTIFICATION # 11006

WESTON
MANAGERS DESIGNERS/CONSULTANTS

WESTON-GULF COAST, INC.
2417 Bon ., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Wednesday August 3rd, 1994

RE: **SWTF-Comp-01 TCLV**
Project # 02871-005-001-0002
Lab ID: **9407G302-007**
Sample Date: 07/18/94
Date Received: 07/20/94
Units: UG/L

VOLATILES BY GC/MS, TCLP LEACHATE

Volatile Compound	Result	Reporting Limit	Flag
Vinyl chloride	BRL	40	U
1,1-Dichloroethene	BRL	100	U
Chloroform	BRL	40	U
1,2-Dichloroethane	BRL	40	U
Carbon Tetrachloride	BRL	40	U
2-Butanone	BRL	200	U
Trichloroethene	BRL	40	U
Benzene	BRL	60	U
Tetrachloroethene	BRL	100	U
Chlorobenzene	BRL	40	U

Roy F. Weston, Inc. - Gulf Coast Laboratories

VOLATILES BY GC/MS, TCLP LEACHATE

Report Date: 08/02/94 22:51

RFW Batch Number: 9407G302 Client: City Of Auburn Work Order: 02871-005-001-0 Page: 1a

	Cust ID:	SWTF-Comp-01 TCLV		SWTF-Comp-01 TCLV		VBLK		VBLK		VBLK		VBLK BS	
Sample Information	RFW#:	007		007 MS		94GVC262-358		94GVC262-MB1		94GVC263-MB1		94GVC263-MB1	
	Matrix:	WATER		WATER		WATER		WATER		WATER		WATER	
	D.F.:	20.0		20.0		20.0		1.0		1.0		1.0	
	Units:	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
	Toluene-d8	93	%	99	%	93	%	96	%	92	%	101	%
Surrogate	4-Bromofluorobenzene	90	%	98	%	91	%	97	%	92	%	101	%
Recovery	1,2-Dichloroethane-d4	94	%	94	%	96	%	108	%	95	%	96	%
			fl		fl		fl		fl		fl		fl
Vinyl chloride		40	U	80	%	40	U	2	U	2	U	87	%
,1-Dichloroethene		100	U	103	%	100	U	5	U	5	U	107	%
Chloroform		40	U	97	%	40	U	2	U	2	U	100	%
1,2-Dichloroethane		40	U	88	%	40	U	2	U	2	U	89	%
Carbon Tetrachloride		40	U	96	%	40	U	2	U	2	U	97	%
2-Butanone		200	U	109	%	200	U	10	U	10	U	114	%
Trichloroethene		40	U	88	%	40	U	2	U	2	U	88	%
Benzene		60	U	96	%	60	U	3	U	3	U	96	%
Tetrachloroethene		100	U	90	%	100	U	5	U	5	U	93	%
Chlorobenzene		40	U	96	%	40	U	2	U	2	U	100	%

*= Outside of EPA CLP QC limits.

Cust ID: **VBLK BSD**

Sample Information	RFW#:	**94GVC263-MB1**
	Matrix:	WATER
	D.F.:	1.0
	Units:	ug/L

	Toluene-d8	99	%
Surrogate	4-Bromofluorobenzene	97	%
Recovery	1,2-Dichloroethane-d4	95	%

===fl===========fl===========fl===========fl===========fl===========fl

''nyl chloride	79	%
,1-Dichloroethene	102	%
Chloroform	97	%
1,2-Dichloroethane	88	%
Carbon Tetrachloride	96	%
2-Butanone	109	%
Trichloroethene	88	%
Benzene	97	%
Tetrachloroethene	88	%
Chlorobenzene	95	%

*= Outside of EPA CLP QC limits.

WESTON MANAGERS DESIGNERS CONSULTANTS

Roy F. Weston, Inc. - Gulf Coast Laboratories
BNA ANALYTICAL DATA PACKAGE FOR
City Of Auburn

LABORATORY CHRONICLE

RFW LOT # :9407G302

CLIENT ID	RFW #	MTX	PREP #	COLLECTN	DATE REC	EXT/PREP	ANALYSIS
SWTF-Comp-01 TCLP	006	W	94GB0455	07/18/94	07/20/94	07/27/94	07/29/94
SWTF-Comp-01 TCLP	006 MS	W	94GB0455	07/18/94	07/20/94	07/27/94	07/29/94
LAB QC:							
SBLKBF	MB1	W	94GB0455	N/A	N/A	07/27/94	07/29/94
SBLKBG	TC1	W	94GB0455	N/A	N/A	07/27/94	07/29/94

SIGNATURE Jeff A. Kaczinski DATE 8-1-94

NY CERTIFICATION # 11006

WESTON MANAGERS DESIGNERS/CONSULTANTS

WESTON ¨LF COAST, INC.
2417 Bonu St., University Park, Illinois 60466
Phones: (708) 534-5200 (219) 885-7077 (815) 723-7533
Fax: (708) 534-5211

ANALYTICAL REPORT

To: City Of Auburn
Roy F. Weston, Incorporated
1635 Pumphrey Avenue
Auburn, AL 36830-4303

Attn: Mr. Frank Burgess

Date: Friday July 29th, 1994

RE: SWTF-Comp-01 TCLP
Project # 02871-005-001-0002
Lab ID: 9407G302-006
Sample Date: 07/18/94
Date Received: 07/20/94
Units: UG/L

SEMIVOLATILES BY GC/MS, TCLP LEACHATE

Semivolatile Compound	Result	Reporting Limit	Flag
1,4-Dichlorobenzene	BRL	50	U
o-Cresol	BRL	30	U
meta & para-Cresol	BRL	30	U
Hexachloroethane	BRL	70	U
Nitrobenzene	BRL	30	U
Hexachlorobutadiene	BRL	80	U
2,4,6-Trichlorophenol	BRL	30	U
2,4,5-Trichlorophenol	BRL	40	U
2,4-Dinitrotoluene	BRL	20	U
Hexachlorobenzene	BRL	20	U
Pentachlorophenol	BRL	60	U
Pyridine	BRL	500	U

Roy F. Weston, Inc. - Gulf Coast Laboratories

SEMIVOLATILES BY GC/MS, TCLP LEACHATE   Report Date: 07/29/94 11:56

RFW Batch Number: 9407G302   Client: City Of Auburn   Work Order: 02871-005-001-0   Page: 1a

Sample Information									
	Cust ID:	SWTF-Comp-01 TCLP		SWTF-Comp-01 TCLP		SBLKBF		SBLKBG	
	RFW#:	006		006 MS		94GB0455-MB1		94GB0455-TC1	
	Matrix:	WATER		WATER		WATER		WATER	
	D.F.:	1.0		1.0		1.0		1.0	
	Units:	ug/L		ug/L		ug/L		ug/L	
			fl		fl		fl		fl
Surrogate Recovery	Nitrobenzene-d5	80	%	72	%	94	%	81	%
	2-Fluorobiphenyl	85	%	71	%	68	%	80	%
	Terphenyl-d14	88	%	78	%	89	%	119	%
	Phenol-d5	31	%	28	%	30	%	31	%
	2-Fluorophenol	48	%	43	%	42	%	42	%
	2,4,6-Br3-phenol	74	%	69	%	74	%	72	%
1,4-Dichlorobenzene		50	U	56	%	5	U	50	U
o-Cresol		30	U	64	%	3	U	30	U
meta & para-Cresol		30	U	58	%	3	U	30	U
Hexachloroethane		70	U	51	%	7	U	70	U
Nitrobenzene		30	U	72	%	3	U	30	U
Hexachlorobutadiene		80	U	54	%	8	U	80	U
2,4,6-Trichlorophenol		30	U	70	%	3	U	30	U
2,4,5-Trichlorophenol		40	U	66	%	4	U	40	U
2,4-Dinitrotoluene		20	U	65	%	2	U	20	U
Hexachlorobenzene		20	U	92	%	2	U	20	U
Pentachlorophenol		60	U	79	%	6	U	60	U
Pyridine		500	U	21 *	%	50	U	500	U

*= Outside of EPA CLP QC limits.

EXHBIIT 2

GUIDELINES FOR THE DISPOSAL
OF NON-HAZARDOUS
PETROLEUM CONTAMINATED WASTES

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

DIVISION 13 - SOLID WASTE PROGRAM

LAND DIVISION
(205) 270-5643)

Revised December 2, 1991

NOTE: These guidelines do not address the requirements for the removal of underground storage tanks. Contact the UST[*1] *Section at (205) 270-5655*

A. Soils which have been contaminated with petroleum material resulting from a spill should be reported to the Field Operation Division [*2] of ADEM. To report spills occurring after normal office hours or on holidays, contact Field Operations through the Department of Public Safety's 24 hour phone at (205) 242-4378. Representatives of the Field Operation Division are not responsible for clean-up activity but available to provide technical assistance to the parties involved.

B. Contaminated material which must be removed from the point of generation must be disposed of in a permitted solid waste disposal facility following ADEM (Solid Waste Branch) approval, or transported to an approved treatment [*3] facility for proper treatment and final disposition.

C. Excavated soils, except for those classified as small quantities[*4], or other wastes which are not known to be contaminated with a petroleum material, but are suspected (ex. - from a service station), should be handled as if they were, until laboratory analysis (limits listed below) confirms that no contamination is present. (NOTE: ALL EXCAVATED WASTES FROM UST SITES MUST BE SAMPLED REGARDLESS OF THE TPH[*5], LEAD ANALYSIS, OR FIELD SCREENING METHOD CONDUCTED WITHIN THE EXCAVATION.) Sampling and analysis of wastes must be conducted by qualified personnel trained in this field.

D. Any volume of soil with a TPH concentration of less than (<)[*6] 10ppm is not considered contaminated and thus is not regulated by Division 13 of the ADEM Administrative Code.

E. Where 100 kilograms (220 lbs) or greater (≥)[*6] of Petroleum Product or Waste must be disposed of and the petroleum product released was either a used, heavy[*13] petroleum material or contained lead, analyses must be performed to determine if the Petroleum Contaminated Waste (PCW)[*8] is a hazardous waste or one needing special disposal (used heavy - TCLP[*9]; leaded gas - total lead (EPA Method 239.2) or TCLP for lead). (NOTE: TOTAL LEAD MAY BE USED AS A SCREENING METHOD BUT TCLP MUST BE UTILIZED IF TOTAL LEAD IS 100.0 ppm OR GREATER.)

F. PETROLEUM CONTAMINATED WASTES SAMPLING & ANALYTICAL REQUIREMENTS*10:

CLASS:	TPH SAMPLING AND ANALYTICAL REQUIREMENTS	LEAD AND HAZARDOUS WASTE ANALYTICAL REQUIREMENTS
a. Light*11	5 grab samples composited to 1 sample. for each 20 yd^3 Standard Method 503 D&E EPA Methods 9071, 418.1 Infra Red	1 grab sample for each 20 yd^3 composited to 1 sample per incident Total lead (EPA Method 239.2) or TCLP for Lead when total lead is 100.0 ppm or greater
b. Medium*12	Same as for Light	Not Required
c. Heavy*13:		
Used	Same as for Light	5 grab samples composited to 1 sample for each 100 yd^3 TCLP Test if TPH > 100 ppm.
Virgin	Same as for Light	Not Required
d. Mixed	Handled on a case-by-case basis	
e. Absorbent*14	NONE	NONE

G. CONCENTRATION LIMITS

(exclusive of small quantities *4)

	CLASS:	TPH	LEAD CONC. TOTAL OR HW*15	MANAGEMENT OPTIONS
a(1)	Light	<100ppm	<100.0 ppm Totals or <5.0 TCLP	For UST sites, place back in excavation, if > 5 feet to groundwater or apply in a thin layer on-site with UST approval.
a(2)	Light	<250 ppm	As above	Manage at a permitted Solid Waste Disposal Facility (sanitary landfill or landfill) with Land Division approval.
a(3)	Light	≥250 ppm	As above	Treat*3 to level in a(1) or a(2) to reduce TPH.
a(4)	Light	NA	≥100.0 ppm Total	Perform TCLP for lead - if ≥ 5.0 ppm. disposal at hazardous waste disposal facility. If < 5.0 ppm, see a(2) or a(3) above.

= =

b(1)	Medium	<100 ppm	NA	For UST sites, place back in excavation, if ≥ 5 feet to groundwater or apply in a thin layer on-site with UST approval.
b(2)	Medium	<500 ppm	NA	Manage at a permitted Solid Waste Disposal Facility up to 300 yd^3 per incident with Land Division approval. If ≥ 300 yd^3 (see item H)
b(3)	Medium	≥500 ppm	NA	Treat to reduce TPH to levels in b(1) or b(2) or see item H.

= =

	Heavy:			
c(1)	Used	<3,000 ppm	TCLP Analysis if TPH >100ppm & Certified Non-hazardous	Manage at a permitted Solid Waste Disposal Facility up to 300 yd^3 per incident with Land Division Approval. If ≥ 300 yd^3 (see item H)

G.	CLASS:	TPH	LEAD CONC. TOTAL OR HW*15	MANAGEMENT OPTIONS
c(2)	Used	≥3,000	Same as above	Manage at select disposal facilities up to 300 yd^3 per incident with Land Division Approval. If ≥ 300 yd^3 (see item H)
c(3)	Used	NA	TCLP Hazardous Wastes	Manage as a hazardous waste. Contact RCRA Compliance Branch (271-7726).
c(4)	Virgin	<3,000 ppm	NA	Manage at a permitted disposal facility up to 300 yd^3 per incident with Land Division Approval. If ≥ 300 yd^3 (see item H)
c(5)	Virgin	≥3,000	NA	Manage at select disposal facilities up to 300 yd^3 per incident with Land Division Approval. If > 300 yd^3 (see item H)
d.	Mixed	Handled on a case-by-case basis		

= =

e.	Absorbent	NONE	NONE	Manage at a permitted disposal facility with Land Division Approval. No free liquids may exist at time of disposal. No strong petroleum odor may exist.

= =

H. Management Options:

(1) Utilize a treatment method contained in "*3" below.

(2) Quantities of medium or heavy PCW > 300 yd^3 may be accepted at select disposal facilities with prior approval from ADEM (Solid Waste Branch) and the landfill operator. If the landfill permittee will not accept the excavated soil, other means of treatment and/or processing will be necessary to make the waste suitable for disposal.

H. Management Options:

(3) Any petroleum contaminated waste in which the original product did not have a flash point < 140 degrees Fahrenheit or would not otherwise be classified as a light petroleum product may be disposed of at a permitted solid waste disposal facility with Departmental approval which has been synthetically lined according to Division 13 requirements. Used, heavy petroleum material such as waste oil, is still subject to TCLP analysis.

(4) Other management options may exist - Prior approval must be obtained from the Department.

I. All regulated amounts and concentrations of petroleum contaminated wastes removed from the point of generation shall be disposed of in an ADEM approved land disposal facility unless otherwise approved by the Department. Solid Waste Disposal Facilities may only accept waste for disposal from their designated service areas without special approval from the Department.

J. All waste to be disposed of in a solid waste disposal facility must be treated, solidified or otherwise managed so that the material will be dry enough to be considered bladeable by landfill personnel and contain no "free liquids" as defined by Method 9095 (Paint Filter Liquids Test).

K. When an accident occurs, such as a wreck, and a petroleum product is spilled onto land or waters of the State and the petroleum product is absorbed with an absorbent *14 , the absorbent material containing the product may be disposed of at an ADEM approved land disposal facility on a case - by - case basis (see "e" above within item G).

L. All requests for disposal must be accompanied with a completed Solid/Hazardous Waste Determination Form with any required analysis included.

= =

*1 **UST:** Underground Storage Tank Program (ADEM - Groundwater Branch - UST Corrective Action Unit).

*2 **Field Operations Division:** Birmingham Office 942-6168; Decatur Office 353-1713; Mobile Office 479-2336; Montgomery Office 260-2700.

*3 **Treatment:** For treatment such as air-drying, mechanical dryer, or incineration (contact Air Division 271-7861); for Bio-remediation sites other than those areas immediately adjacent to removed underground storage tanks, (contact Engineering Services Branch - Land Division 271-7726).

*14 **Absorbent:** A material specifically designed for absorbing petroleum spills on an emergency basis. Such material includes, but is not limited to absorbent pads and booms, and is commercially available for purchase.

*15 **HW:** Hazardous Waste

Sue R Robertson 12/5/

Sue Robertson, Chief
Land Division

GLM/102

Water Supply and Sewerage

ERNEST W. STEEL

PROFESSOR OF CIVIL ENGINEERING
UNIVERSITY OF TEXAS

FOURTH EDITION

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ATTACHMENT 9

WATER SUPPLY AND SEWERAGE

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II

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If a standard per capita oxygen demand is adopted, it will be possible to express the strength of a sewage in terms of its population equivalent. For example: A sewage of known flow per day and known B.O.D. exerts a total oxygen demand of 10,000 lb. per day. Dividing this amount by 0.17 gives 59,000 as the population equivalent.

Population equivalent is useful in rating the strength of industrial wastes in connection with the treatment loads that they place upon municipal sewage treatment plants. It has been advocated as a means of assessing charges for waste treatment against industries, rather than consideration of volume only. It also has a field of usefulness in expressing the loads upon filters and other sewage treatment units.

20-15. Sewage Treatment Methods. It is usually necessary to provide partial or complete treatment of sewage before it can be disposed of, although some cities dispense with treatment because they are indifferent to the consequences or are favorably situated and can discharge raw sewage into very large bodies of water or into streams that traverse uninhabited country.

Choice of the treatment method or combination of methods calls for careful consideration by the engineer. The factors that enter into the decision, in the order of their importance, are (*a*) the method of final disposal and, if by dilution, the amount and character of the diluting water and conditions along the stream, lake, or bay; (*b*) the character of the sewage; (*c*) the skill required in operation and the quality of operation that the plant is likely to receive; (*d*) the characteristics of the site of the plant and possibility of lawsuits should odors or other nuisances occur; (*e*) head available for the plant and necessity for pumping of the sewage if there is insufficient natural head; (*f*) first cost and cost of operation; (*g*) ease of increasing capacity.

The requirements of state health departments must be considered. These are concerned with obtaining effluents of high quality and with prevention of hazards to public health and nuisances.

Below is an outline of disposal and treatment methods of sewage and the sewage solids. The term *primary treatment* of sewage is applied to those methods which remove a part of the suspended and floating solids. The *secondary treatments* provide some means of satisfying oxygen demand. They are usually preceded by one or more of the primary treatments. A plant may give primary treatment only, in which case the effluent is said to be only partially treated. If secondary treatment is provided, the sewage is frequently designated as completely treated, although this may be far from the case. Disinfection of sewage is sometimes practiced, but it may be used as a primary treatment or as a final treatment before disposal.

METHODS OF SEWAGE DISPOSAL

1. Dilution or disposal into water
2. Irrigation or disposal on land
    - *a*. Application to surface
    - *b*. Subsurface irrigation

METHODS OF SEWAGE TREATMENT

I. Primary treatments
- *A*. Removal of floating solids and coarse suspended solids by
    1. Racks
    2. Medium screens
    3. Grit chambers
    4. Skimming tanks, with or without aeration
- *B*. Removal of fine suspended solids by
    1. Fine screens
    2. Sedimentation by
        - *a*. Plain sedimentation tanks, with or without mechanical sludge-removal devices
        - *b*. Septic tanks
        - *c*. Imhoff tanks
        - *d*. Chemical precipitation tanks

II. Secondary treatments
- *A*. Oxidation by
    1. Filters
        - *a*. Intermittent sand filters
        - *b*. Contact filters
        - *c*. Trickling filters
    2. Aeration
        - *a*. Activated sludge
        - *b*. Contact aerators
    3. Chlorination
    4. Oxidation ponds

III. Disinfection
- *A*. Chlorination

METHODS OF TREATING SEWAGE SOLIDS

I. Screenings
- *A*. Medium by
    1. Shredding and digestion
- *B*. Fine screenings by
    1. Digestion

II. Settled solids (sludge)
- *A*. Primary-treatment and humus-tank sludges by
    1. Digestion
    2. Conditioning
        - *a*. By elutriation
        - *b*. With chemicals
    3. Vacuum filtration
    4. Drying
        - *a*. On beds
        - *b*. In kiln driers

B. Excess activated sludge by
1. Thickening
2. Digestion
3. Conditioning with chemicals
4. Vacuum filtration
5. Drying (as primary sludges)

Methods of Disposal of Sewage Solids

I. Screenings
A. Medium by
1. Burial
2. Incineration

B. Fine by
1. Burial
2. Incineration

II. Sludges
A. Wet sludges by
1. Dumping at sea
2. Piping to sea

B. Dried or dewatered sludges by
1. Incineration
2. As fertilizer
3. For filling low ground

Table 20-4. Efficiencies of Sewage Treatment Methods

Type of treatment	Per cent reduction		
	Suspended matter	B.O.D.	Bacteria
Fine screens	5–20		10–20
Plain sedimentation	35–65	25–40	50–60
Chemical precipitation	75–90	60–85	70–90
Low-rate trickling filter, including presedimentation and final sedimentation	70–90+	75–90	90+
High-rate trickling filter, including presedimentation and final sedimentation	70–90	65–95	70–95
Conventional activated sludge, including presedimentation and final sedimentation	80–95	80–95	90–95+
High-rate activated sludge, including presedimentation and final sedimentation	70–90	70–95	80–95
Contact aeration, including presedimentation and final sedimentation	80–95	80–95	90–95+
Intermittent sand filtration, including presedimentation	90–95	85–95	95+
Chlorination:			
Settled sewage		[1]	90–95
Biologically treated sewage		[1]	98–99

[1] Reduction is dependent upon dosage.

CHAPTER 24

Sewage Filtration

24-1. Objectives. Filtration of sewage is a secondary method of treatment having for its object the oxidation of putrescible matter remaining after the primary treatments. It employs* aerobic bacteria which act upon organic matter in suspension and in solution. B.O.D. will therefore be satisfied by filtration (not merely reduced by removing unstable matter), and more or less nitrification will be accomplished. It is possible, therefore, to produce a stable liquid by filtration through the soil, the aerobic bacteria which coat the soil particles being available to oxidize both solids filtered out and material in solution. The sewage filter approximates soil conditions but uses a more porous material to allow freer movement of air through the filter and greater dosing rates. Several types of filters are in general use.

INTERMITTENT SAND FILTER

24-2. Theory. The intermittent sand filter was an early development in sewage treatment. Because of the large area required, filters of this type are seldom constructed by cities. They are, however, suitable for institutions, as hospitals, outside of cities, and are becoming more popular for use by motels and small residential areas where subsurface disposal of septic tank effluents is not practical. They have the following important advantages: (1) Head requirements are small. (2) Operation is simple and mechanical equipment need be no more elaborate than a dosing siphon. (3) The effluent is of excellent quality, with high removals of B.O.D. and coliform bacteria. The latter effect makes chlorination for disinfection simple. (4) There is little or no trouble with insects, and odor troubles are negligible. (5) There is no secondary sludge to dispose of.

Settled sewage is applied intermittently to the sand surface. As the sewage sinks through the sand, suspended solids are removed and held on the sand grains. The intermittent action permits entrance of air into the

* The effluent filters described in Art. 23-11 are an exception. Their action is mechanical only, and must be classed as a primary treatment.

bed and maintains aerobic conditions. The biological action in the filter is mainly carried on by bacteria[1] of which the zoogloeal forms are most numerous but other types occur. These decompose organic nitrogen compounds and destroy carbohydrates. Protozoa, most of which feed upon bacteria, are also to be found. Higher multicellular animal forms, known as metazoa, which include annelid worms, nematodes, and rotifers,

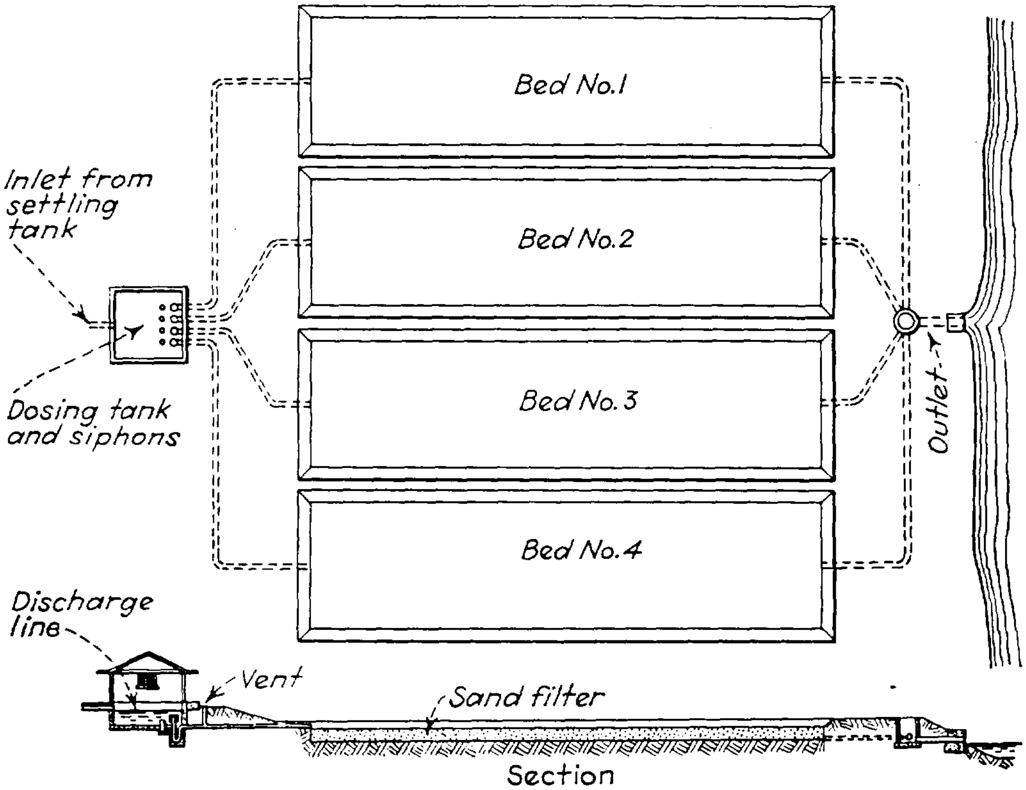

FIG. 24-1. Layout of intermittent sand filter installation.

feed upon the organic slimes and by digestion and utilization of the material transform it into porous masses which can be further worked upon by bacteria and other organisms. It is this action which keeps the bed open for penetration by air and at the same time consumes solid organic matter without formation of a sludge. This condition also reduces the allowable dosage. This is in contrast to the trickling filter in which the humus-like products of the metazoa are sloughed off to form a sludge which must be settled out in sedimentation tanks.

24-3. Design. The sand used should have an effective size between 0.20 and 0.50 mm.[1] Finer material will clog rapidly and coarser material may permit too deep penetration of fine solids and make even distribution of doses difficult. The uniformity coefficient* should be between 2.0 and 5.0. Bed depths are from 18 to 30 in. Loadings have usually been expressed in gallons per acre per day with variations from 75,000 to

* For definitions of effective size and uniformity coefficient see Art. 10-4.

250,000. Studies made in Florida[2] by Grantham, Emerson, and Henry indicate relationships between loading and effluent quality. They discovered that at loading rates of 125,000 to 150,000 g.p.a.d. 93 to 95 per cent removals of B.O.D. from the applied sewage could be expected on sand of 0.25-mm. size, 89 to 93 per cent removals on 0.30-mm. sand, and 83 to 88 per cent removals on 0.45-mm. sand, when bed depths were 18 to

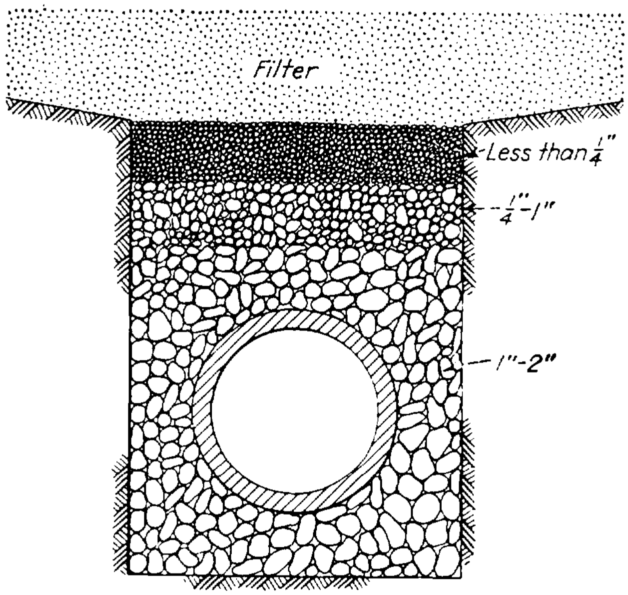

FIG. 24-2. Underdrain of an intermittent sand filter.

30 in. The larger percentages were obtained in the 30-in. bed. Slightly greater efficiencies, about 2 per cent, were obtained at loadings of 100,000 g.p.a.d. Observations of clogging indicated that a loading of 125,000 gal. should not be exceeded for 0.25-mm. sand, while 150,000 gal. should not be exceeded for any size sand. In the study the B.O.D. loadings were 148 lb. per acre per day for 0.25 mm. sand and 164 lb. per day for 0.30- to 0.45-mm. sands. The loadings varied from 1.4 to 6.4 lb. of B.O.D. per 1,000 cu. ft. of sand.

In the study one dose was applied to the beds per day. One bed was observed with split dosing, i.e., the daily load was applied in two doses. It was found that this would allow heavier daily loads with efficiency comparable with single dosing. It should be remembered that the above figures apply to Florida where temperatures are favorable. Winter efficiencies in northern climates would be somewhat lower.

The above dosages are based upon usual practice, which provides for application of presettled sewage to the beds. At some of the older plants raw sewage was applied, in which cases doses were usually about 50,000 g.p.a.d.

When sand filters are used as a finishing treatment, where especially good effluents are required, perhaps after trickling filters with or without humus removal, dosing rates are much higher. The rate may possibly be 500,000 g.p.a.d. if proper provision can be made for intermittent dosage and resting periods.

Sand filters are highly efficient from the standpoint of reduction of B.O.D. and suspended solids. They also produce highly nitrified effluents, and bacterial reductions will probably exceed 95 per cent.

24-4. Construction. Beds are usually constructed in unlined excavations in the earth. The bottom is sloped gently toward the underdrains placed in trenches below the bottom of the sand. The underdrains are of tile pipe laid with joints about 3/8 in. apart. Some engineers use a plastic clip, which is now obtainable, to fit over the upper half of the pipe joint. These prevent entrance of small particles, help in alignment and, by means of lugs, insure proper spacing. The pipe is surrounded by crushed stone or gravel to prevent sand from sifting into it. Next to the pipe a 3-in. layer of 1- to 2-in. material is placed, next to this 3 in. of 1/4- to 1-in. material, and next a layer smaller than 1/4 in. The pipes should be laid on a grade of 0.5 per cent or greater and about 30 ft. apart. It is desirable that they be arranged to permit rods to be passed through for cleaning purposes.

Beds are usually rectangular and in units of 1/4 to 1 acre. The smaller units are used in the smaller installations in order to have a sufficient number to provide flexibility in operation and avoid too large a proportion of idle bed area when a unit or units are resting.

24-5. Distribution on Beds. Intermittent dosage is a necessity, but the frequency varies widely at different plants. It is common to apply a single dose per day, although as many as three are applied at some installations. There will, of course, be a relationship between the number of doses per day, the size of the dose, the capacity of the plant, and the number of beds. Large doses will require a longer resting period than small ones. For example, a 1-acre bed receiving 100,000 gal. in a single dose should not be dosed again for 24 hr. At least three beds and preferably four will be needed to insure flexibility of operation and proper rates of application.

The dosing may be regulated by hand with valves in lines leading to the various beds, although dosing tanks and siphons that work automatically are more generally used. The latter method also has the advantage of applying the sewage rapidly and thereby allowing more even distribution over the sand surface. The dosing tank is constructed of concrete and has a capacity equal to the desired single dose for a bed. In very small installations a single siphon* may be placed in the tank. When the tank is full, the siphon goes into operation, empties the tank quickly, and then cuts off. Successive doses are applied to the same bed for a whole day.

* The action of the dosing siphon is described in Art. 24-21.

The next day the second bed is dosed, while the first rests. With three beds, each will work 1 day and rest 2 days. A fourth bed may be used to allow the beds to rest, in rotation, for a week or more. A more elaborate arrangement is to place a number of siphons in the dosing tank.[3] These can be arranged by the manufacturers of such equipment to operate alternately and dose each bed successively, with a resting period long enough to obtain reaeration between doses. It should be recognized that the siphons used must have a capacity at lowest head greater than the peak sewage flow at the end of the design period, or the dosing tank will not be emptied, the siphon will not cut off, and a bed will be dosed continuously until the inflow decreases to the siphon capacity.

The sewage is applied to the bed surface in various ways. Uniform dosage is best obtained by having a single inlet pipe per bed and having it discharge into a trough. The trough may run down the middle of the bed; or, if the bed is square, it may have branches. Ports or gates in the sides of the trough allow the sewage to flow on the sand. The troughs may be of wood strongly cross braced to prevent excessive warping.

24-6. Operation. If the plant is not automatically dosed, the operator must manipulate valves in the pipe lines so that intermittent dosage and necessary resting periods are obtained. With automatic dosage it will still be necessary to observe bed condition and put beds out of operation when they require resting or cleaning. The need for complete rest will be indicated by septic conditions in portions of the bed, and the resting period should be at least 1 week and 2 or 4 weeks if the condition is serious. Septic conditions are especially likely if the top portion of the sand is clogged. A large proportion of the suspended solids that enter the sand are oxidized, but some are transformed into humus which remains in the sand. This will not only interfere with reaeration but also cause pooling upon the surface. Resting and raking the bed surface will be beneficial. If a layer of solids collects upon the sand, it should be scraped or swept off. As the clogging becomes more pronounced, it will be necessary to remove the top 2 or 3 in. of sand and replace it with clean material. It is not economical to wash the dirty sand. Where raw sewage is applied to sand filters, the coarse suspended solids form a dense mat on the surface. The mat itself acts as a filter and prevents fine material from penetrating the bed. From time to time as the mat becomes too thick it is necessary to remove it by raking. It is buried or dumped on low ground.

Winter operation presents some difficulty, as there is danger of the sand surface freezing. Usually at the beginning of cold weather the bed is ridged on 3-ft. centers with intervening furrows, and the ice, when it forms, is held up by the ridges to make a covered channel beneath, in which future doses flow.

CONTACT BEDS

24-7. The contact filter is now of historical interest only. For a time it was popular because of its greater capacity per unit area than intermittent sand filters and irrigation. The indifferent quality of the effluent and the superiority of activated sludge and the trickling filter in practically all pertinent considerations has led to its abandonment. It could treat 0.4 to 0.6 m.g.a.d.

The beds, usually two or more in number, were generally 4 ft. deep and filled with crushed stone, usually about 1- to 2-in. in size.

1. *The Filling Period.* In this stage the settled sewage was applied to the bed as quickly as possible without dislodging the organic film.

2. *The Standing-full Period.* During this the sewage was in contact with the film-covered filter medium. The solids of the sewage became attached to the surfaces of the filtering medium, and the soluble contents were, to some extent, adsorbed by the organic film. This stage did not exceed 2 hr. to prevent the establishment of anaerobic conditions. In any case there was some deoxygenation, and some of the nitrates formed during the standing-empty period were decomposed, and gaseous nitrogen liberated.

3. *The Emptying Period.* This stage had no significance in the treatment process but was accomplished without undue disturbance of the film. A 1-hr. emptying period was usual.

4. *The Standing-empty Period.* During this period of 3 to 4 hr. air penetrated the bed, thus permitting aerobic bacteria to oxidize the organic matters deposited during the standing-full portion of the cycle. During this part of the cycle the action of the contact bed was similar to that of the sand filter, and it continued until refilling the bed set up a brief period of anaerobic action.

The complete cycle required about 8 hr. Dosing tanks and siphons, with interlocking arrangements, were used to dose the beds, successively and automatically, and timed siphons were used to empty them.

TRICKLING FILTERS

24-8. The trickling filter, also known as the sprinkling or percolating filter, is widely used. The development of high-rate types has added to the adaptability of this method of treatment to many needs and conditions and has greatly increased its popularity.

24-9. Theory. A trickling filter is a bed of crushed stone, gravel, or slag of relatively large size, to which settled sewage is applied by sprinkling on the surface. The applied sewage trickles in a thin film over the surfaces of the filtering medium which have become coated with a zoogloeal film. Fine suspended solids are removed and held by the film, and colloidal material is adsorbed by it. Since air is present in the filter, a large population of aerobic bacteria will inhabit the film and work upon suspended, colloidal, and dissolved organic solids which have become concentrated in and upon it. This brings about a reduction of B.O.D., ammonia, and organic nitrogen and, particularly in the lower part of the bed, formation of nitrates. The concentration of organic matters in the film from the applied sewage explains why sewage is adequately treated even though only a short period is required for it to trickle from top to bottom of the bed. A new bed must acquire its zoogloeal film before it is very efficient. The time required will usually be about 2 weeks, although this may be decreased if filter effluent is recirculated to the bed.

The film includes zoogloea-forming and other bacteria, fungi, protozoa, and algae. Protozoa feed upon bacteria and will reduce the number of coliforms in the applied sewage about 50 per cent in a 5-ft.-deep filter. Larger animals, as worms, may also be present, but the zoogloea-forming bacteria are most important. The film becomes heavy and thick at times with dead organic matter which has been worked over by the various organisms, and this sloughs off, to appear in the effluent as humus-like suspended matter, which still exerts some B.O.D. This sloughing or unloading is noted in all trickling filters but is especially pronounced in the spring at Northern installations. The accumulated material apparently interferes with the aerobic bacteria and reduces efficiency. A bed that unloads continuously, thereby keeping retained worn-out film and dead matter to a minimum, usually shows better all-time efficiency. A thin transparent film upon the stones indicates a favorable condition. The unloading characteristics of trickling filters make it necessary to give final sedimentation to the effluent.

As pointed out in Art. 20-5 bacteria and associated organisms are continuously active when food is available and do not need resting periods. With substrates as encountered in sewage treatment the more food that is available, the more active they will be. Therefore the upper portions of a trickling filter are more effective than the lower portions in removal of B.O.D., and this also explains why, when trickling filters are operated in series, the secondary filter has a lower efficiency than the primary filter.

Temperature will affect the efficiency of trickling filters. It can be assumed that, where winters are moderately severe, the final effluent from a trickling filter plant will have a B.O.D. about 20 per cent greater in the winter than that in the warm months.

24-10. Pretreatment. Effective presedimentation of the applied sewage is essential to good performance of the filters; otherwise suspended solids may cause clogging, in addition to applying a heavier load than is desirable. It is considered good practice to provide a sedimentation period that w— reduce the B.O.D. of the raw sewage about 30 to 35 per cent. This should be accomplished with a detention period of 2 to 2.5 hr. and overflow rate of 650 to 900 gal. per sq. ft. per day, with tank depths of 8 to 10 ft. Where recirculation is practiced the volume of sewage returned to the primary sedimentation tank must be considered in arriving at the detention period and overflow rate.

24-11. Classification of Filters. Trickling filters are classified as low-rate filters, also known as standard or conventional filters, and high-rate filters. The terms low- and high-capacity filters have also been used.

Low-rate filters. Since this was the first type of trickling filter developed, it is also known as the standard or conventional filter. The settled sewage is applied to the bed surface, and after trickling through it passes to the final sedimentation tank for removal of most of the unloaded solids. It is unusual, but may be desirable, to recirculate some of the filter effluent.

High-rate filter. To this filter the settled sewage is applied at a much higher rate than to the conventional filter. There is no standard relationship between the two rates of dosage, but in general the load on the high-rate filter, in terms of 5-day B.O.D., not including the recirculated load, is four to five times that applied to the low-rate filter. The dosing, in terms of liquid applied per unit area, including recirculated sewage, is from five to fifteen times that of the low-rate filter. The high-rate filter is characterized by recirculation of the sewage, usually continuously, but in some types only during low flows. When an especially good effluent is desired two filters may be provided to operate in series with various schemes of recirculation. This is known as two-stage filtration. The plant may, however, be designed to permit operation of the two filters in parallel.

Comparison of Effluents. Usually the efficiency of a trickling filter is combined with that of the sedimentation tank following it. For this combination in the low-rate filter plant a good removal of the 5-day B.O.D. applied to the filter is feasible, varying from 75 to 90 per cent, depending upon the loading, type of sewage, and design details. The high-rate filter plant can be varied to meet different needs. It may be designed to produce an effluent which is somewhere between primary treatment alone and complete treatment. Single-stage treatment, with proper attention to loading and sedimentation tank design, can produce an effluent approaching that of the standard filter plant, but production of very well-treated effluents will probably require two-stage filtration, particularly if the sewage is strong.

Effluents of high-rate filters have their suspended solids more finely divided than those of standard filters and are lacking in nitrates, although two-stage filters may provide some nitrification. The former indicates necessity for good design of final sedimentation tanks. Usually the dissolved oxygen content of the effluent is about 50 per cent of saturation and this, if accompanied by a low B.O.D., will be favorable for final disposal into a stream.

High-rate filters, as well as low-rate, have the advantage of withstanding shock loads and overloads with considerable success. They do not break down completely but continue to effect a significant B.O.D. removal under any reasonable loading, unless a toxic material is in the sewage or the temperature throughout the medium of the bed falls close to freezing.

24-12. Recirculation. Recirculation, while seldom used at standard filter plants, is a feature of high-rate filtration. Its advantages are that it (1) allows continuous dosage of the filters regardless of fluctuations in flow and thus keeps beds working more nearly continuously; (2) freshens influent and thus reduces odors; (3) seeds the filter continuously with organisms and enzymes; (4) removes worn-out film, thus reducing film thickness and aiding in control of filter fly breeding (Art. 24-34); (5) equalizes and reduces loading and thus improves efficiency.

The effect of recirculation in reducing B.O.D. of the effluent is sometimes obscured by the fact that it also increases the load applied to the filter. The effect can be demonstrated as follows:[4]

Let F = filter load in pounds of B.O.D. per day; L = additional load in the recirculated flow in pounds B.O.D. per day; E = final effluent after recirculation take-off in pounds B.O.D. per day.

Then the total filter load is $F + L$, which will be reduced to some fraction—say, ⅓. Then

$$\frac{F+L}{3} = \text{settled filter effluent}$$

and

$$E = \frac{F+L}{3} - L \quad = \frac{F+L}{3} - \frac{3L}{3} = \frac{F+L-3L}{3}$$

or

$$E = \frac{F}{3} - \frac{2L}{3}$$

It is apparent that the effluent is less in B.O.D. by $2L/3$ than if there were no recirculation.

24-13. Loading of Filters. Filter loading in terms of 5-day B.O.D. is expressed in pounds per day per 1,000 cu. ft. of filter medium (not including B.O.D. of recirculated flow). For low-rate filters the range is 5 to 25 lb. and for high-rate filters, 25 to 300 lb. Some state health departments express permissible loadings in terms of pounds per acre-foot as 400 to 600 lb. for low-rate filters (or 9.16 to 13.74 lb. per 1,000 cu. ft.) and for high-rate filters 2,000 to 5,000 lb. (45.8 to 114.5 lb. per 1,000 cu. ft.).

Loading is also expressed in terms of millions of gallons of sewage applied per day per acre (m.g.a.d.) of bed surface; the terms hydraulic load, surface load, or liquid load are applied to this. Surface loads for standard filters are from 2 to 4 m.g.a.d., including any recirculated sewage, with 2 to 2.5 most common. High-rate filters are dosed at rates varying from 10 to 30 m.g.a.d. or more, including recirculation. Gallons per day per square foot of surface area has also been advocated as the unit, with the low-rate range as 25 to 100 and the high-rate range as 200 to 1,000. A simple calculation will determine the volume of filter medium and surface area necessary.

Example. A settled sewage, average flow 1 m.g.d., 5-day B.O.D., 150 mg./l., is to be applied to a standard trickling filter. The loading is to be 10 lb. per 1,000 cu. ft. of filter medium per day. Surface load is to be 2 m.g.a.d. Determine the volume of the filter and depth.

Solution.

$$\frac{150 \text{ mg./l.} \times 1.0 \text{ m.g.} \times 8.34 \text{ lb.}}{10 \text{ lb.}} = 125{,}000 \text{ cu. ft.}$$

Since the surface loading is to be 2 m.g.a.d., the required surface area will be 0.5 acre, and the filter depth will be $125{,}000/(43{,}560 \times 0.5) = 5.75$ ft.

24-14. Efficiencies. Trickling filters show wide variations in the satisfaction of B.O.D. in relation to loading. It is supposed that these variations are caused in large part by differences in the "treatability" of the sewage, i.e., the readiness with which its unstable organic matter is oxidized. Amount and character of grease and presence of industrial wastes may affect this adversely or otherwise. Temperature is also a factor, since trickling filters are more effective at the favorable temperatures for rapid bacterial action. More study of performances of filters is needed to provide definite design data as to loading and performance, but the results of several investigations are available.

A study of sewage treatment[5] plants at military installations by a committee of the National Research Council included 34 standard and high-rate trickling filters. The performances and efficiencies* varied, but averages were obtained and the following formula was developed:

$$E = \frac{100}{1 + 0.0085\sqrt{w/VF}} \qquad (1)$$

in which E is the efficiency in per cent of removal of 5-day B.O.D. of the filter and final sedimentation tank, w is the weight in pounds per 24 hr. of the B.O.D. applied to the filter, V is the volume of the filter in acre-feet, F is the number of effective passages of the sewage through the filter. If

* Performance is applied to the amount of B.O.D. or suspended solids removed, while efficiency is the per cent removed.

it is assumed that at each passage the amount removed decreases by 10 per cent because of a lessened response to treatment, then the combination of this factor with the hydraulic recirculation factor can be expressed by the following formula:

$$F = \frac{1 + R}{(1 + 0.1R)^2} \tag{2}$$

in which R is the recirculation ratio, or ratio of recirculated sewage to the average flow of the raw sewage; F is the number of effective passages through the filter. When there is no recirculation, F is unity. Figure 24-3 shows curves derived from formula (1) for several recirculation rates.

The formulas and curves are applicable to standard and high-rate filters with or without recirculation. For two-stage filtration, formula (1) and Fig. 24-3 will apply to the first-stage filter. The sewage applied to the second filter, however, will have been reduced in treatability because the more readily oxidized material will have been removed by the first filter. Hence a modification of formula (1) is suggested by the committee mentioned above,[4] for the second-stage filter,

$$E_2 = \frac{100}{1 + [0.0085/(1 - E_1)]\sqrt{w'/VF}} \tag{3}$$

in which E_2 is the efficiency in per cent of the second-stage filter and final sedimentation tank, E_1 is the efficiency of the primary filter and the following sedimentation tank, expressed as a decimal, w' is the weight in pounds of 5-day B.O.D. applied to the filter, V is the volume of the filter in acre-feet, F is the number of passages through the filter and is obtainable from formula (2).

24-15. Requirements of Upper Mississippi River and Great Lakes Boards of State Sanitary Engineers. A group of state sanitary engineers have developed design criteria for trickling filters to be used in the 10 states under their jurisdiction. These criteria differ in some respects but not materially from those of the National Research Council. The loadings for standard and high-rate filters with per cents of B.O.D. remaining are shown in Fig. 24-4. The effect of subsequent settlement is included but not that of recirculation. This figure takes into consideration the important effect of climate upon the efficiency of filters. It shows lower efficiencies at very high loading rates than do the formulas, which is probably correct. The figure is used for standard and high-rate filters as follows:

The standard filter's removals to be expected are as shown, with a maximum allowable loading of 15 lb. per 1,000 cu. ft. Filter media depth should be not less than 5 ft., nor more than 7 ft. Liquid loading should

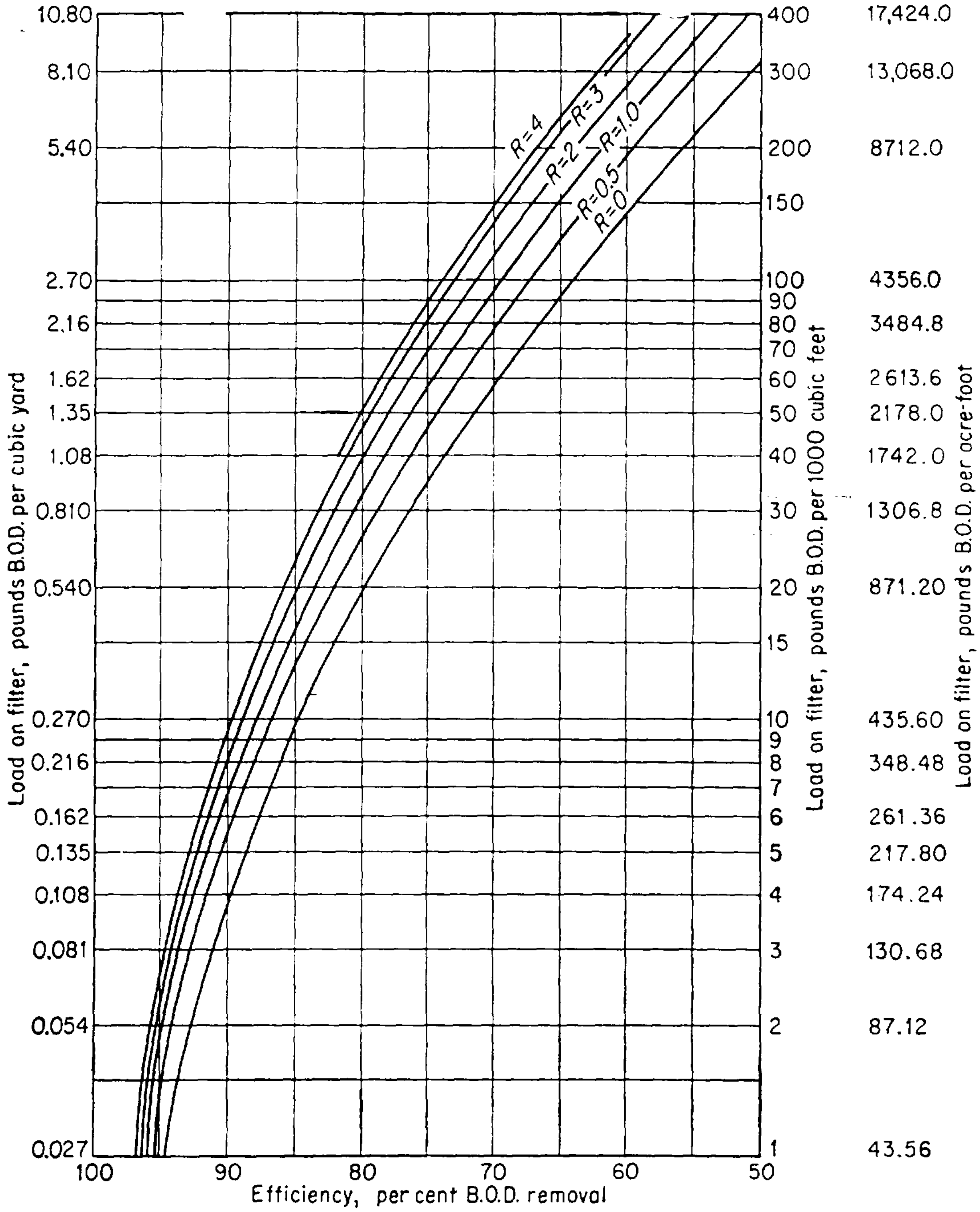

FIG. 24-3. Curves of first-stage trickling filter efficiencies, including after sedimentation, based upon the National Research Council formula.

not exceed 4 m.g.a.d. Consideration should be given to provision of recirculation if the sewage to be treated is strong.

For high-rate filters a controlled recirculation system must be provided to maintain a continuous dosing rate equal to or in excess of 10 m.g.a.d. A single-stage filter may be used where a settled effluent with a B.O.D. of 30 mg./l. or more is acceptable and where the applied load, recirculation included, does not exceed 110 lb. of B.O.D. per 1,000 cu. ft. per day. The recirculation system must supply sufficient dilution to the settled sewage so that the B.O.D. of the influent to the filter, recirculation included, shall not exceed three times the B.O.D. of the required settled effluent before take-off for recirculation. Two-stage filters are considered as a means of reducing the B.O.D. of settled effluent below 30 mg./l. if the B.O.D.

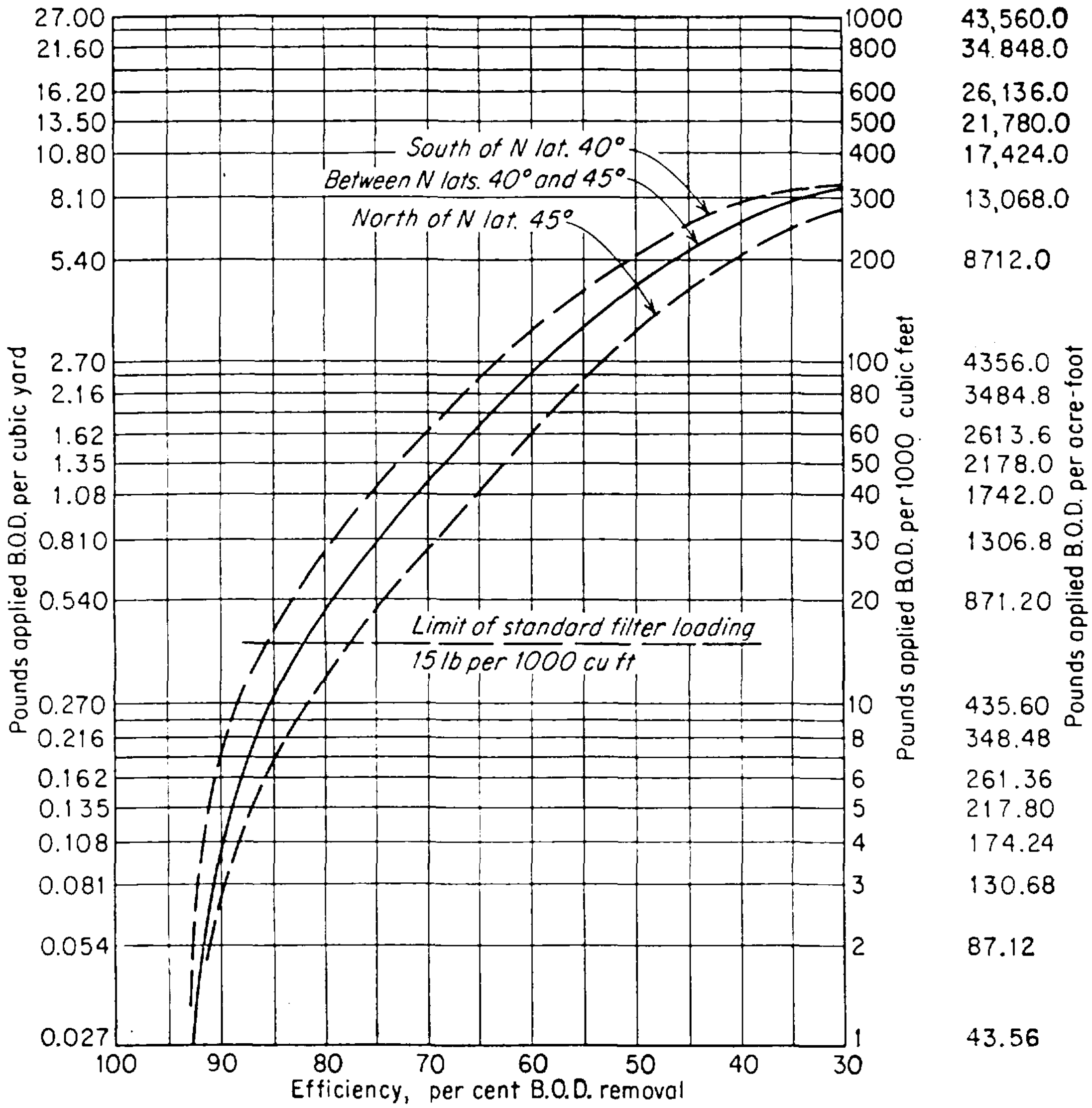

FIG. 24-4. Curves of trickling filter efficiencies, including after sedimentation but no recirculation, based upon requirements of the Upper Mississippi River and Great Lakes Boards of State Sanitary Engineers.

load applied to the second-stage filter, recirculation included, does not exceed two times the B.O.D. expected in the settled effluent before take-off for recirculation. When the effluent of the first-stage filter is applied directly to the second-stage filter without intermediate settling, the assumed B.O.D. removal by the first-stage filter shall not exceed 50 per cent.

The curves of Fig. 24-4 can be used with recirculation by proportioning values of F, as obtained by formula (2). If, for example, loading on a filter is to be 50 lb. p 1,000 cu. ft. with a recirculation 1:1, then the ratio of the two values of F, with and without recirculation, will be 1.65. The efficiency obtained will be as shown in Fig. 24-4 for a loading of 50/1.65, or 30.3 lb. per 1,000 cu. ft. The efficiency will be 74 per cent for a latitude between 40° and 45°. At the actual loading of 50 lb. without recirculation the efficiency would be 67 per cent. It will be noted that these results are somewhat different from those that would be obtained with Fig. 24-3, which gives higher efficiencies.

24-16. Design of Standard Trickling Filter. Application of the above data to the design of a standard filter is indicated by the following example:

Example. A trickling filter plant is to treat 1.5 m.g.d. The raw sewage has a 5-day B.O.D. of 180 mg./l. The State Health Department specifies a final effluent with a B.O.D. of not over 20 mg./l. It also specifies a bed depth of not less than 5 ft. nor more than 7 ft. and B.O.D. loading not to exceed 600 lb. per acre-ft. per day.

Solution (*using N.R.C. formula*). A usual assumption is that primary sedimentation will remove 35 per cent of the B.O.D., leaving, in this case, 117 mg./l. to be applied to the filter. The B.O.D. applied to the filter will therefore be

$$180(1 - 0.35)1.5(8.34) = 1{,}460 \text{ lb. per day}$$

Of this, (117 − 20) ÷ 117 or 83 per cent must be removed, i.e., this efficiency must be attained. The above figures can then be substituted in formula (1), remembering that in this case $F = 1$. It is found that $V = 2.52$ acre-ft. This is a loading at the rate of 1,460 ÷ 2.52 = 580 lb. per acre-ft. per day or 13.3 lb. per 1,000 cu. ft. At a depth of 6 ft. the filter area will be 2.52 ÷ 6 = 0.42 acre. The liquid loading will be

$$1{,}500{,}000 \div 0.42 = 3{,}580{,}000 \text{ gal. per acre per day}$$

This might exceed loadings suggested by the state and necessitate reducing the depth to 5 ft. and increasing the area, resulting in a liquid load of 3 m.g.a.d. Figure 24-3 could also be used after determining the required efficiency. The allowable loading, 13.3 lb. per 1,000 cu. ft. can be read directly.

Solution (*using Upper Mississippi curves*). If it is assumed that the latitude is between 40° and 45°, then from Fig. 24-4 with an efficiency of 83 per cent the results will be the same as with the formula.

24-17. Design of High-rate Trickling Filter. Since varying rates of recirculation may be involved, arriving at filter volumes for a high-rate filter may require trial methods using various recirculation rates. An example is given below, and for comparative purposes the same conditions are set up as for the standard filter in the preceding example. It is assumed that the permissible loading is 3,000 lb. per acre-ft., or 68.9 lb. per 1,000 cu. ft., a common limit set by the states.

Example. A sewage having a B.O.D. of 180 mg./l. and daily flow of 1.5 m.g.d. is to be treated so that the B.O.D. will be reduced by 35 per cent in the primary tank, making the daily B.O.D. load applied to the filter 1,460 lb. per day. It is assumed that two filters of equal size will be constructed to operate in series.

Solution. The total filter volume will be 1,460 ÷ 3,000 = 0.488 acre-ft., of which each filter will contain 0.244 acre-ft. The recirculation rate is assumed to be 1:1, in both filters, i.e., the returned sewage is equal to the average daily flow. F, as obtained from formula (2), is 1.65. The load w on the primary filter is 1,464 lb., and V is 0.244 acre-ft. Substitution in formula (1) indicates an efficiency of 65.1 per cent, or a removal of 969 lb. of B.O.D. The remaining B.O.D. to be applied to the second-stage filter will be 1,464 − 969 = 495 lb., which will be w' for the secondary filter. The values of V and F will be the same as for the first-stage filter. Substitution in formula (3) indicates an efficiency of 53.2 per cent for the second stage. This leaves 232 lb. in the final effluent and a B.O.D. of 18.5 mg./l. This is a slightly better effluent than specified, but it should be recognized that attainment of effluents with very low B.O.D. is difficult and a factor of safety is desirable. Note that the total filter volume required for the high-rate plant is only about one-fifth of that of the standard filter. This saving is offset in part by the larger sedimentation tanks, and the necessity of pumps, wet wells, and piping for recirculation.

Liquid loading will be as follows, assuming a filter depth in each unit of 3 ft. Area will be 0.244 ÷ 3 = 0.081 acre. The liquid loading will be (1.5 + 1.5)/0.081 = 37 m.g.a.d.

The above solution would not satisfy certain of the Upper Mississippi requirements. It will be noted that the B.O.D. load applied to the second filter, including recirculation load is 495 lb. + (232 ÷ 2) = 611 lb. This is more than twice the 232 lb. in the effluent before take-off of the recirculated sewage. Therefore, the first-stage filter must be redesigned to reduce the load for the second-stage filter.

24-18. Bio-filter. The bio-filter is a high-rate filter, usually 3 to 4 ft. in depth, employing recirculation at all times.[4] The flow diagrams used are shown in Fig. 24-5. The single-stage intermediate treatment shown will produce an effluent between primary treatment and complete treatment, with 60 to 65 per cent over-all removal of B.O.D. Effluents from single-stage complete treatment will approach conventional plant effluents with moderately strong sewages and proper design as to loading and recirculation, i.e., 85 per cent removal of B.O.D. or more over-all. In Fig. 24-5*c* the total recirculation is the sum of the two recirculations. Two-stage treatment should be used for strong sewages and where very good effluents are desired. Bio-filters can be designed for flexibility in operation, particularly two-stage plants; i.e., filters may be operated in parallel as conventional filters when less-well-treated effluents are desired, or the primary filter may be operated at high rate with recirculation and the secondary without recirculation. The filter beds are invariably circular and are dosed by means of rotary apparatus.

24-19. Accelo Filter. This system includes recirculation of unsettled effluent from the filter back to the inlet of the filter distributor as shown by the flow diagram of Fig. 24-6. It is used for both low-rate and high-rate filters, the former being applicable if a well-nitrified effluent is required. The principle claimed for this system is that the direct return

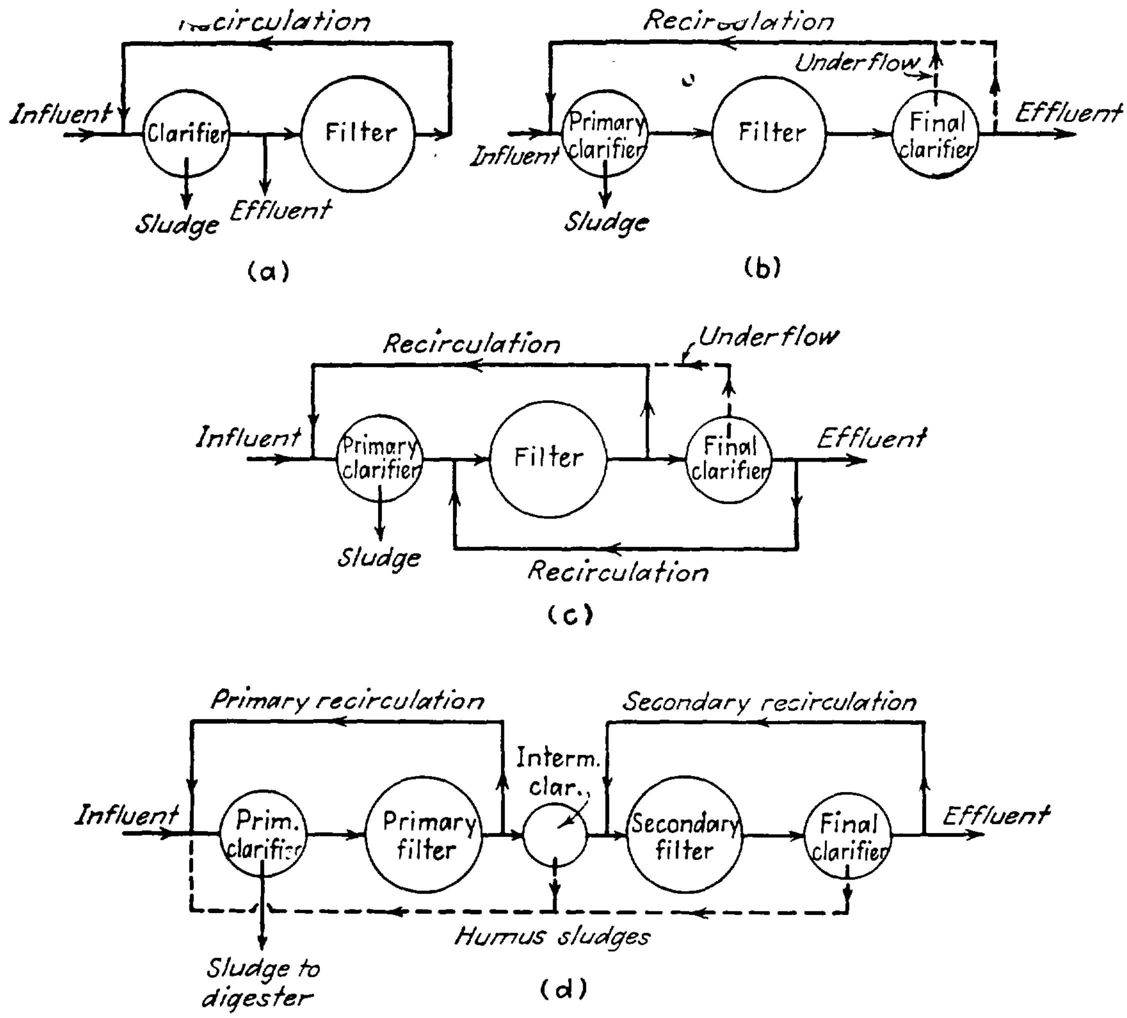

FIG. 24-5. Bio-filter flow diagrams. (*a*) Single-stage intermediate treatment. (*b*) Single-stage complete treatment. (*c*) Single-stage complete treatment with dual recirculation. (*d*) Two-stage treatment. Intermediate clarifier is sometimes omitted.

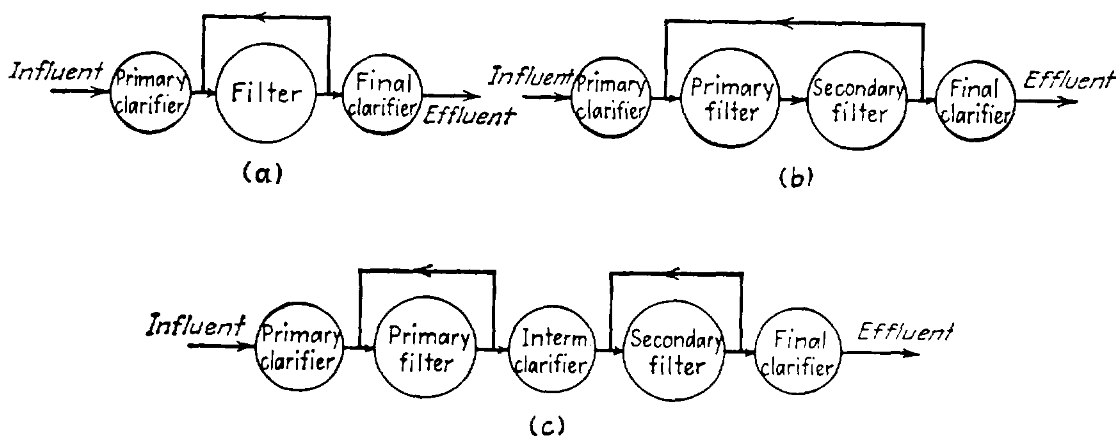

FIG. 24-6. Flow diagram of Accelo filter. (*a*) Single-stage filter. (*b*) Two-stage plant with dual recirculation to the primary filter. (*c*) Two-stage plant with direct recirculation within each stage. Intermediate clarifier is sometimes omitted.

of filter effluent intensifies biological oxidation.[4] Low-rate filters may be dosed at liquid rates of 3 to 6 m.g.a.d., while high-rate types are dosed at liquid rates of 10 to 30 m.g.a.d. B.O.D. loadings recommended are 1,613 to 2,420 lb. per acre-ft. per day (37 to 51 lb. per 1,000 cu. ft.) for single-stage high-rate filters in the Northern states, and 3,000 lb. (69 lb. per 1,000 cu. ft.) for the Southern states. Where a low-rate filter is indicated a B.O.D. loading of 400 to 600 lb. per acre-ft. (9.2 to 13.8 lb. per 1,000 cu. ft.) per day is recommended. Bed depth is not less than 6 ft. for both high- and low-rate filters. As previously mentioned the Upper Mississippi regulations (Art. 24-15) permit a maximum efficiency of only 50 per cent for the primary filter of a two-stage filter plant if the plant does not provide an intermediate settling tank.

24-20. Aero Filter. This is a special type of high-rate filter.[4] The others discussed depend upon recirculation for intimate contact of sewage with the biological film. The orginators of the aero filter claim to attain

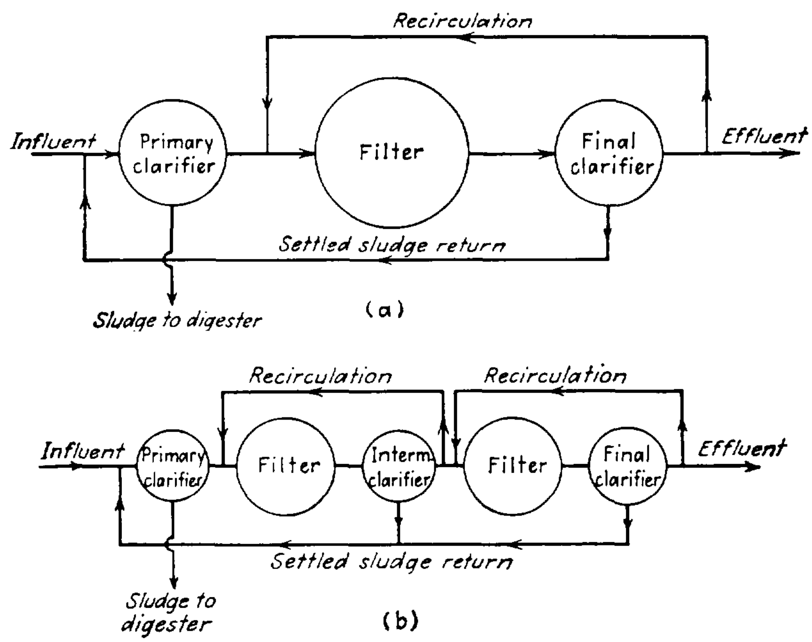

FIG. 24-7. Flow diagram of aero-filter plants. (*a*) Single-stage plant. (*b*) Two-stage plant.

the same result by use of distributors which, so far as possible, apply the sewage continuously and uniformly over the surface of the bed so that a thin film of sewage trickles continuously over the filter medium. For beds not over 34 ft. in diameter this is accomplished by a motor-driven disk which produces a rain of sewage over the bed. For larger beds a multiple-arm rotating distributor of special design is used which doses each radius of the circular filter every 10 sec.[4] Recirculation is of two types. One, termed nonparallel recirculation, merely maintains a rate above a minimum on the filter and thus equalizes sewage flow variations.

The par l recirculation is used for strong wages and is used to dilute the applied sewage. Recommended rates for varying sewage strengths are:

Max. B.O.D. of settled sewage, mg./l.	*Recirculation ratio*
130	Nonparallel
170	1:1
220	2:1
260	3:1
325	4:1

Two-stage filtration is recommended for strong sewages. It is claimed that a properly designed and operated aero filter will remove 75 to 80 per cent of the applied B.O.D. when using nonparallel recirculation, provided the application rate does not exceed 3,200 lb. of B.O.D. per acre-ft., or 74.5 lb. per 1,000 cu. ft. Beds are usually 6 ft. or greater in depth and, in two-stage plants, 60 to 65 per cent of the total filter medium is generally placed in the first-stage filter.

DETAILS OF LOW-RATE FILTER

24-21. Dosing by Nozzles. In American practice the oldest dosing method is by means of fixed nozzles which spray the sewage on the bed surface. While many old plants still use this method it has been superseded in new plants by rotary distributors. The nozzles are supplied from a pipe grid which receives the discharge from one or more siphons and dosing tanks. This arrangement allows the intermittent action which was formerly considered desirable for trickling filters, and the varying head changes the spray radius as the tank empties. To obtain more nearly uniform dosage per unit of area as the head decreases, the plan area of the dosing tank is also decreased as the tank is emptied, as shown in Fig. 24-8.

Design of a filter using the nozzle method requires knowledge of the characteristics of spray nozzles and siphons, and these must be obtained from the manufacturers, the Pacific Flush Tank Company.[6] Figure 24-8 shows a single dosing tank and siphon with the nomenclature used in design. The siphon operates as follows: Assume that the siphon has cut off at the low-water line. Water will be standing in the discharge pipe of the siphon at the level of A, which is the same elevation as the nozzle orifices, and also at B in each of the two pipes of the blowoff trap as indicated. As the water runs into the dosing tank the level rises, in a short time covering the open end of the siphon vent. Thereafter, as the water level rises, air is compressed under the bell; the water level in the discharge pipe is depressed from A, and at the same time down the blowoff trap toward D.

This proceeds until the water level is at the maximum discharge line of the tank, while at the same time the water level under the bell is near the upper end of the discharge pipe. In the discharge pipe it is at C, and in the blowoff trap it is at D. Discharge is now impending, and a slight increase of head in the tank causes the water level at D to be depressed

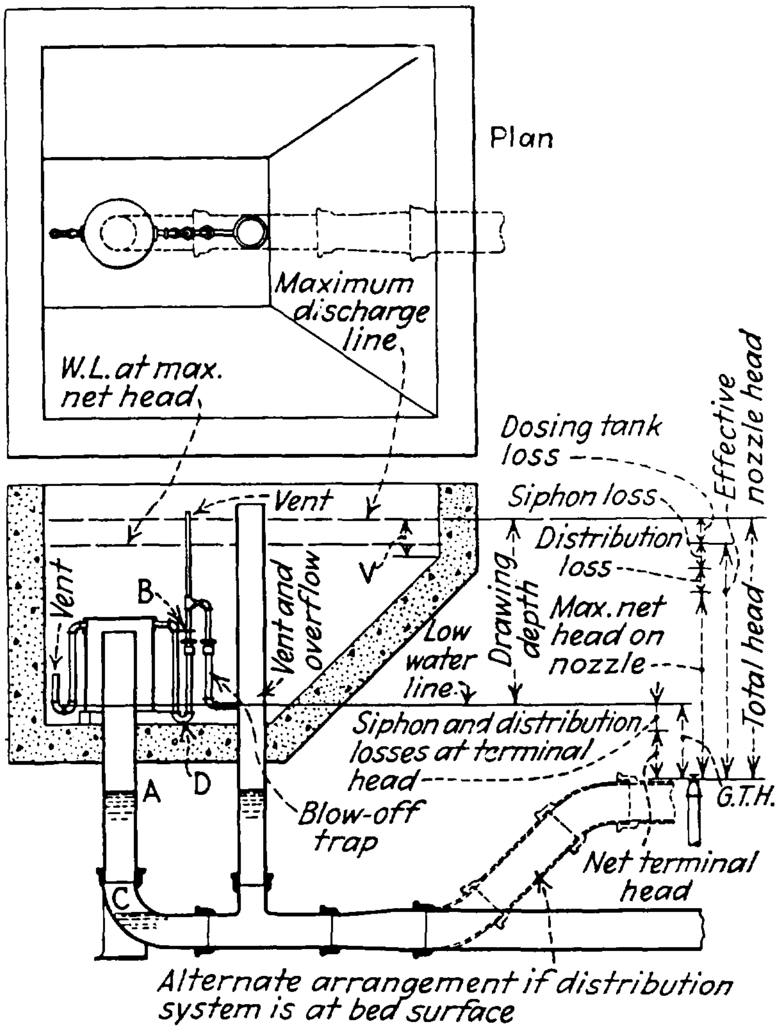

FIG. 24-8. Dosing siphon and tank.

sufficiently to allow the air pressure to be released with considerable violence up the vent pipe. This sudden release allows water to rush into the discharge pipe; momentum causes discharge through the siphon and into the distribution system, and the tank is emptied. Emptying continues until the water level in the tank is below the elbow of the siphon vent. This permits air to enter the bell, relieve the vacuum, and stop the discharge. Water has also been running through the blowoff trap so that it will be filled when the siphon stops.

The various heads shown in Fig. 24-8 are factors in the design of the dosing and distribution system. The nozzles used are pictured in Fig.

24-9. They should be so spaced, in relation to the maximum head, that there will be some overlapping of the sprays. This is necessary to obtain fairly uniform distribution at the higher heads of the dosing cycle. By partial closure of the opening, semicircular sprays are obtainable for use near the bed walls. The nozzles may be tapped directly into the cast-iron pipe distributors, if they are placed at the bed surface or at the ends of risers if the distributors are placed at the bottom of the bed. Arrangements used are shown in Fig. 24-8.

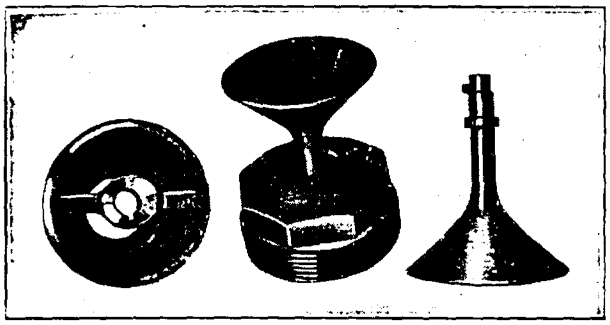

FIG. 24-9. Type C circular spray nozzle. (*Courtesy Pacific Flush Tank Company.*)

There are several disadvantages to the nozzle distribution method. From 7 to 10 ft. head is required between the maximum water level in the dosing tank and the surface of the filter. Odor nuisances are common since the sprays allow escape of H_2S and other odorous gases. The aeration obtained during the process is of no practical value.

24-22. Rotary Distributors. The rotary distributor has largely superseded the fixed nozzle system. It has the disadvantages of requiring smaller filter units and they must be circular, but the advantages are smaller operating head and less danger of odors since the sewage is not sprayed upward into the air. The distributor consists of two or more pipe arms which rotate in a horizontal plane as the result of the reaction of the sewage leaving the orifices, which are all on the same side of the pipes. Distributors are obtainable from several manufacturers in sizes to care for beds up to 200 ft. in diameter. Usually they will care for flows varying from maximum to minimum of 2½ to 1, although the extreme variation may require 4 ft. of head on the orifices.

Frequently during the day the flow of sewage will not fall within the minimum and maximum limits set by the distributor. In this case a dosing tank and siphon, similar to that of Fig. 24-8 but shallower, will be required for each bed. Dosing tanks are small, usually with only 2-min. detention period at twice the average flow so that dosing is nearly continuous. The drawdown, i.e., the vertical distance between the maximum water level in the tank and the level when the siphon cuts off, is kept to 10 or 12 in., and the cutoff level is usually 6 to 12 in. above the level of the orifices. The total head required may be itemized as follows:

The entrance loss, including that of the siphon, may be taken as $4V^2/2g$, in which V is the velocity in the filter feed pipe. The dosing-tank loss, which is the drop in water level in the tank required to fill the distributor arms. The friction loss in the feed pipe, including losses due to bends

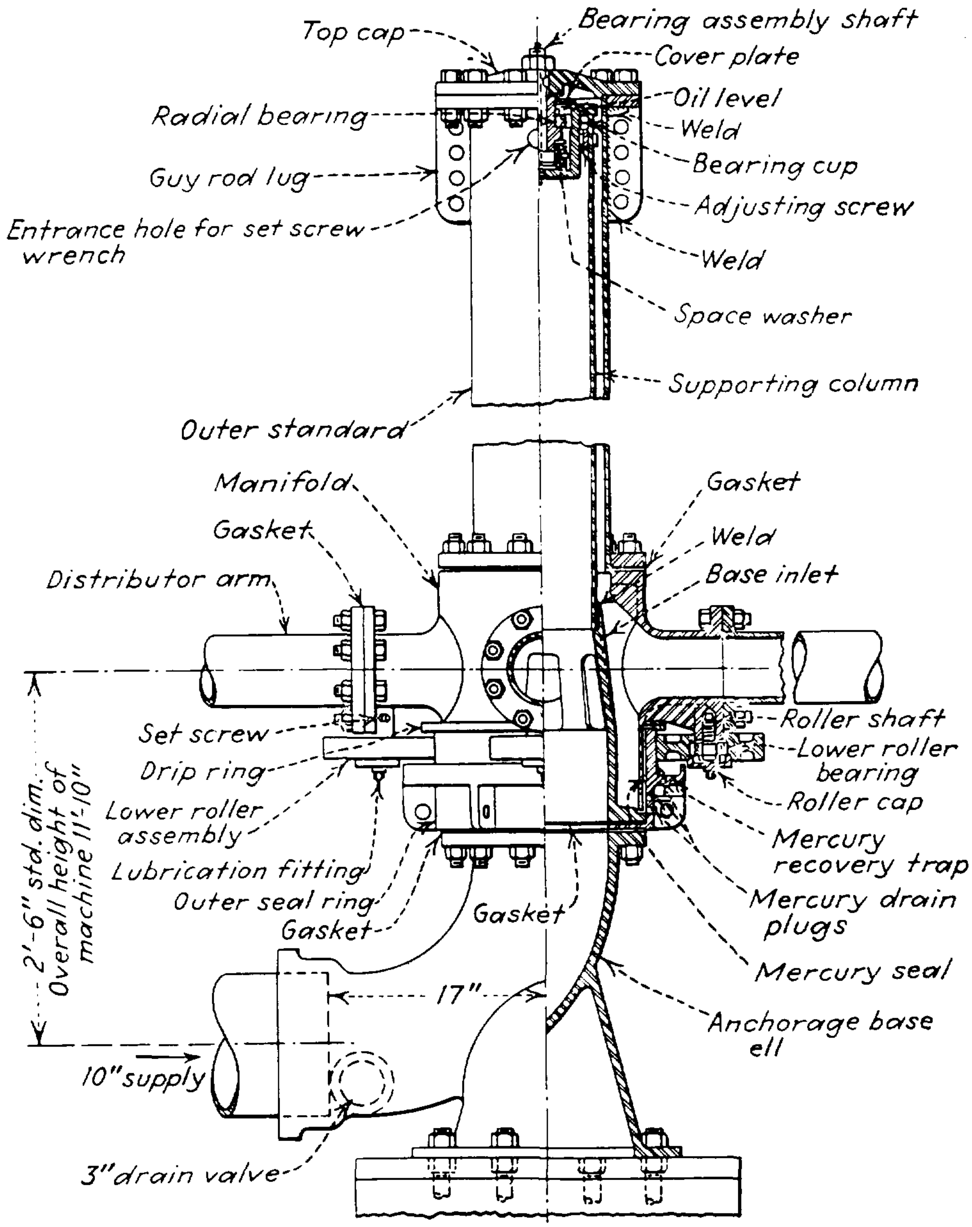

FIG. 24-10. Details of riser pipe and connection to rotating arms. (*Courtesy Pacific Flush Tank Company.*)

and changes in velocity head if the pipe decreases in diameter. The distributor loss, which must be obtained from the manufacturer and which is usually not less than 12 in. The distance from the centerline of the distributor arms to the surface of the bed, usually 6 in.

The manufacturer should be consulted as to siphon and distributor characteristics. Ordinarily the high-water level in the dosing tank will be 2 to 4.5 ft. above the level of the orifices. Where head must be conserved special distributor designs are obtainable from manufacturers that will reduce the total head to less than 2 ft. One arrangement is to confine the low flows to one pair of the four arms. This will also permit maximum flows to be five times the minimum. The orifices have deflector plates in front or beneath them to spread the jet. Spaces and sizes of orifices vary along the arms to obtain uniform dosing.

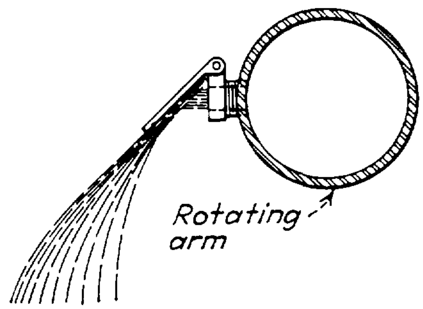

FIG. 24-11. Hinged deflector plate.

If the sewage flow is fairly constant, as when it is pumped or recirculated, no siphon is required and a head box or tank discharges into the filter feed pipe. In this case the head required will include entrance, friction, and distributor losses in addition to the distance between the orifices and the bed surface. Since the first three losses named depend upon the square of the velocity the ratio of head required at maximum flow to that at low flow will vary as the squares of the flows.

The influent flows to the distributor through the feed pipe, which is under the bed, or supported on columns in the bed, to a riser pipe which supports the distributor. A concrete column usually supports the vertical pipe. Mercury is frequently used as a seal to prevent leakage of sewage between the fixed support arm and the moving manifold to which the distributor arms are attached.

24-23. Filter Media. The media used are crushed stone, slag, and gravel. Theoretically, irregularity is desirable as providing more surface, but too great roughness may interfere with unloading. Actually the film smooths off the irregularities, although a slight tendency toward more uniform unloading is noted in gravel filters. In efficiency there is little to choose between crushed stone, slag, and gravel. Cost should govern in choosing among the three media mentioned.

Media of small size will furnish more surface, but unloading will be less complete and ponding on the surface is more likely. It is common to specify size of the medium between limits of 1 in., as 1½ to 2½ in. or, following a present tendency, as 2½ to 3½ in. A few states specify 2 to 4 in.

The material used must be free of sand and clay and durable, particularly in cold climates where freezing may cause disintegration and clogging. The traprocks, granite, quartzite, and slag are highly durable, while limestone is variable in this quality. Whatever is used should be tested by the sodium sulfate accelerated soundness test, which nearly approximates freezing and thawing. It consists of immersing 10 pieces of the rock of approximately equal size and totaling 1,000 gm. in weight in a saturated solution of sodium sulfate for 20 hr. at 70°F. The stones are then dried at 100°C. for a period of 4 hr. The cycle is repeated twenty times. A piece that breaks into three or more parts, each being 10 per cent or more of the piece by weight or losing 20 per cent or more by chipping or flaking, has failed the test. If 20 per cent or more of the pieces of the sample fail, the material is considered unsound.[4] For further details as to specifications and placing of media see Art. 24-29.

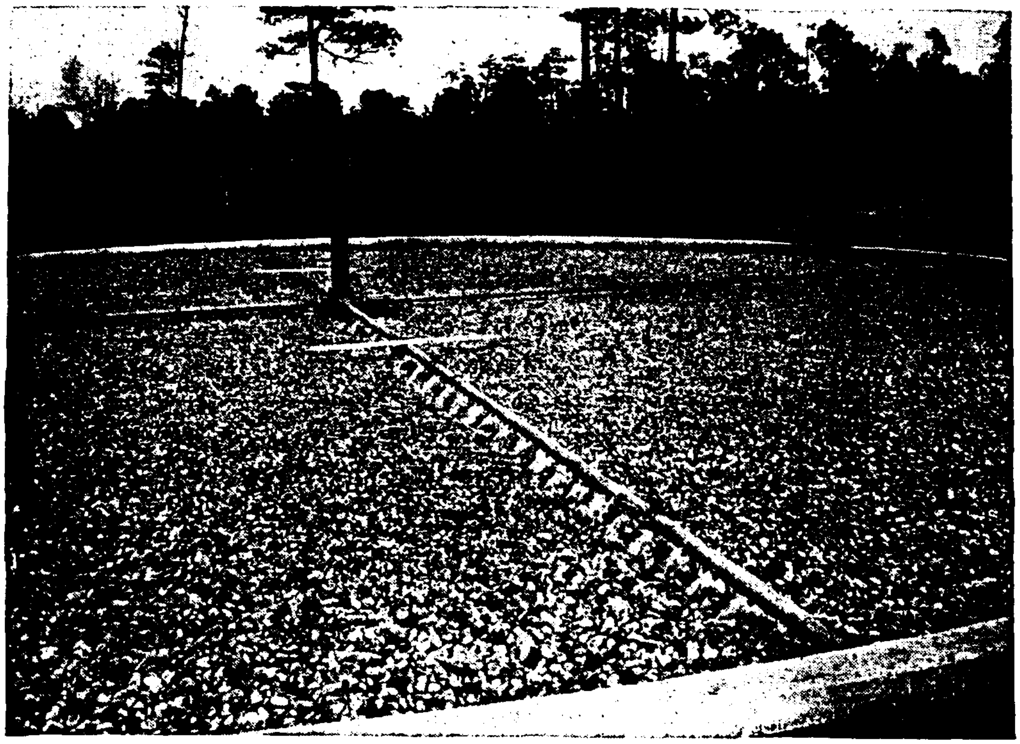

FIG. 24-12. Rotary distributor, 90 ft. in diameter. Southern Pines, N.C.

24-24. Underdrain System. The underdrain system carries off the effluent as it reaches the bottom of the filter and also aids in distribution of air throughout the bed. It is important that all channels be large enough and with enough slope to prevent clogging even after long use. A reinforced-concrete floor is constructed on an adequately compacted subgrade and sloped 0.3 to 1.0 ft. per 100 ft. to a main drain. In rectangular filters the main drain usually follows the longer centerline. In circular filters it generally follows a diameter, although in some cases it may be slightly off the diameter to avoid the central column and in a few cases at the periphery and actually outside of the bed. The lateral drains are obtained by using some type of vitrified clay block and placing it on the sloping floor so that continuous channels are formed at right angles to and discharging into the main drain.[4] Some of these blocks are shown in Fig. 24-13. All have slots in the top which are smaller than the smallest filter stones. They are laid directly on the concrete floor, on a thin layer of grout or a very thin sand bed. They may be purchased under specifications of the American Society for Testing Materials.[7]

The main drain should have such cross section and slope that it will only flow partly full at 2 to 3 ft. per sec., allow unsubmerged outlets for the lateral channels, and have its own outlet unsubmerged. For low-rate filters many engineers consider that adequate ventilation will be so obtained, but some provide for more air circulation by placing vertical 4-in. vitrified tile pipes from the underdrains to the bed surface at the

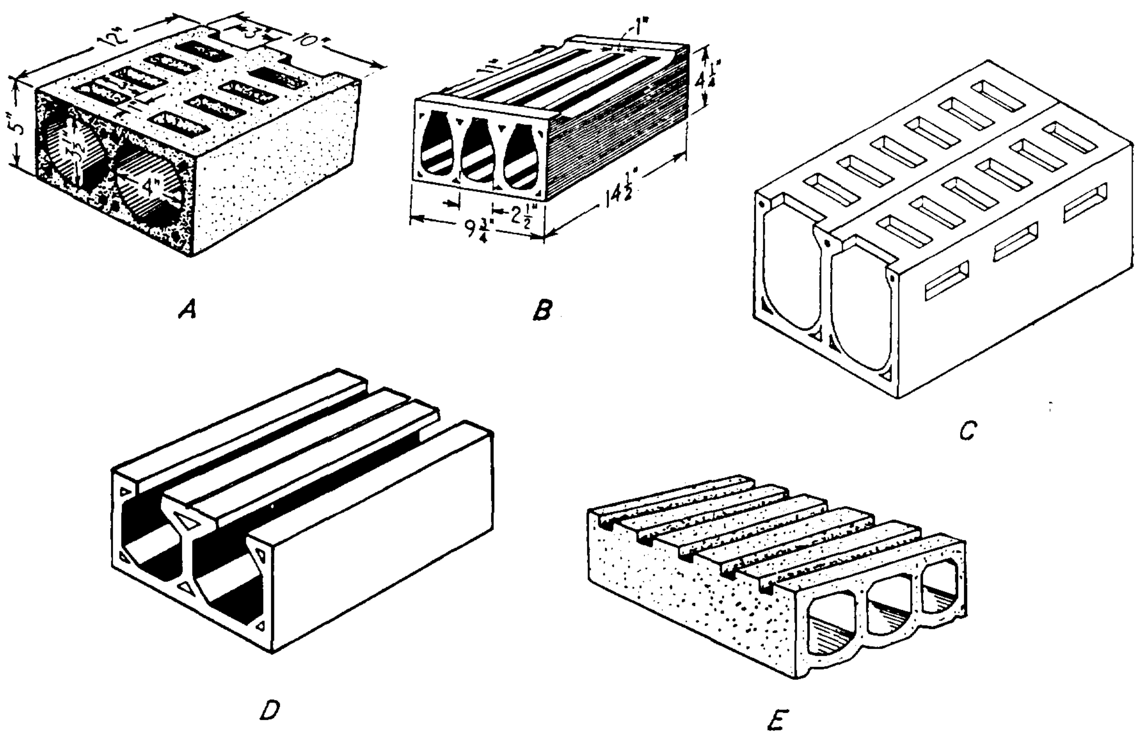

FIG. 24-13. Blocks used in underdrain system of trickling filters. *A*, Armcre block; *B*, Natco tile; *C*, Armcre block with lateral ventilating slots; *D*, Metro monounit type; *E*, Cannelton block.

upper end of each line of blocks. Such riser pipes also permit flushing of the drains. Cover blocks are obtainable with sockets for such pipes. Special blocks are also made for the main drain. If it must be very wide it may be divided by a thin wall so that two blocks can be placed across. At the central column the main drain is usually around it on one side, with a small channel around the other side to intercept the flow from the laterals on that side (Fig. 24-14).

24-25. Bed Construction. The older beds, using fixed nozzles for distribution, were rectangular, but at present, with rotary distributors in general use beds are circular. Some early beds were constructed without walls, the filter media being piled at its angle of repose. Usually a wall is used, and it may be either tight or open. Open walls have openings through them to aid ventilation, but they do not permit flooding to control the Psychoda fly (Art. 24-34) and in cold climates may allow freezing of parts of the bed. Tight walls are more generally used. They are usually of concrete 8 to 12 in. thick. Reinforced vitrified segmental tile blocks have also been used. A freeboard of 6 to 9 in. above the surface of the filter is generally furnished with rotary distributors, and 12 in. for fixed nozzle filters.

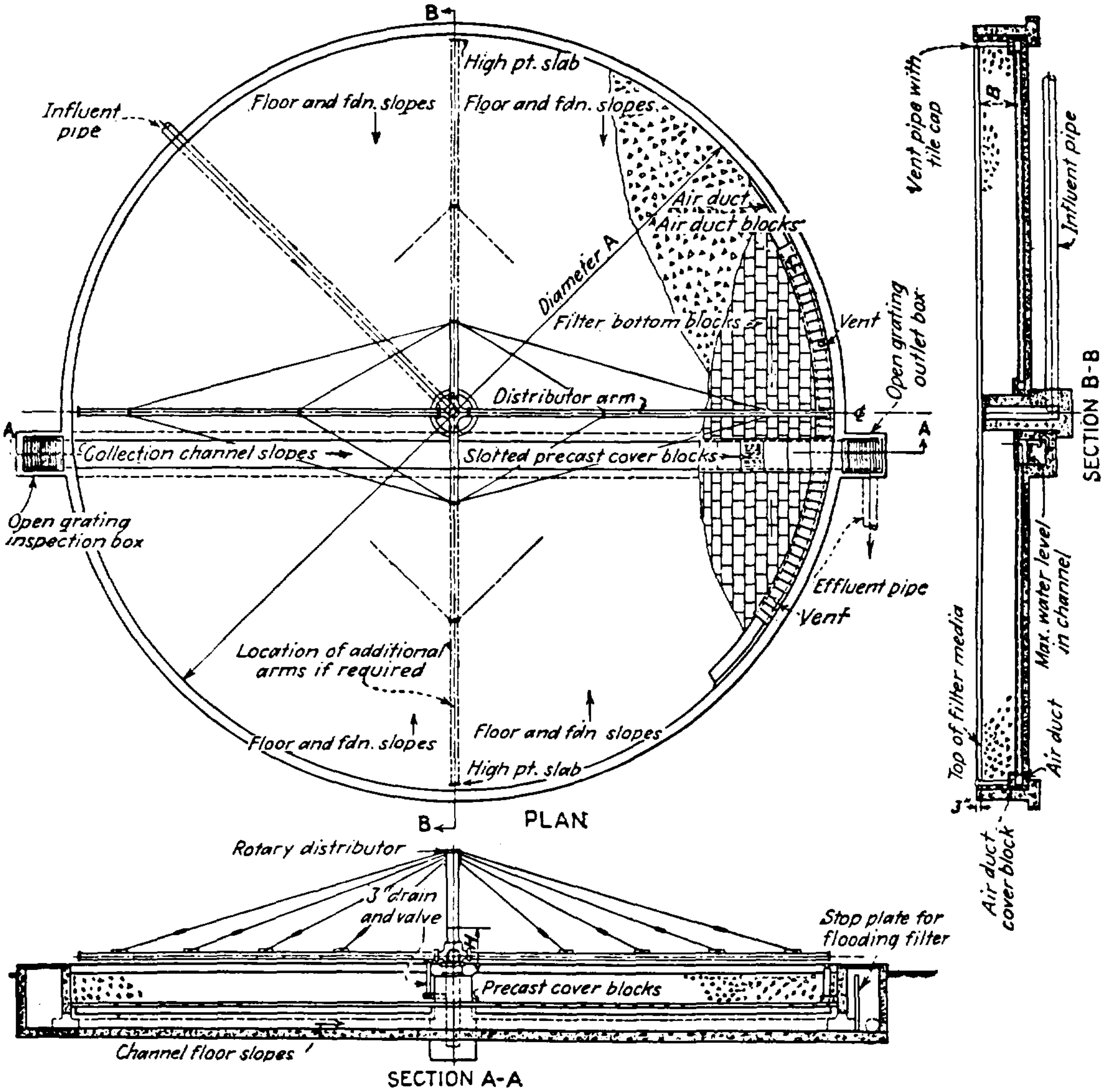

FIG. 24-14. Plan and sections of a circular trickling filter. *(Courtesy Link-Belt Company.)*

24-26. Final Sedimentation. Although some older low-rate filter plants were constructed without final sedimentation tanks good practice requires that they be included. The solids of the filter effluent, as the result of biological action, are less putrescible than the applied solids, but they still exert a B.O.D. and if allowed to remain in contact with the effluent will remove dissolved oxygen and perhaps set up septic conditions. Hence for good conditions in the receiving water they should be removed, in large part, by sedimentation. Some state health departments permit a detention period of 1 hr. for such tanks in low-rate filter plants but $1\frac{1}{2}$ to 2 hr. is desirable, with a surface loading of not over 900 gal. per day per sq. ft. No scum removal will be necessary, but frequent or continuous removal by sludge-moving mechanisms is desirable. Details may be the same as for any well-designed pretreatment tank. The tank should remove about 60 per cent of the suspended solids and 40 per cent of the B.O.D. of the influent.

DETAILS OF THE HIGH-RATE FILTER

24-27. Rotary Distributors. High-rate filters are invariably dosed by rotary distributors. Since recirculation is practiced, variations in flow are usually not great, dosing will be continuous, and siphons are unnecessary. Ratio of maximum to minimum flow is usually about 2:1, occasionally 3:1. Head requirements will depend upon the entrance loss, friction in the feed pipe and arms, and necessary head at the orifices. As with low-rate distributors, for a flow ratio of 3:1, the head at maximum flow would be nine times that at low flow. Manufacturers overcome this difficulty in part by providing one set of orifices for low flows and two sets for high flows, the change-over being automatically controlled by the flow rate. This is obtained by using only two arms of four during low flows or using two-compartment arms, one above the other. Such devices will permit flow ratios as 3.5:1 with only 3 ft. of head at maximum flow between the stone and the maximum water level in the center column. To this must be added entrance loss from the head box and loss in the feed pipe. In the high-rate filters the distributor arms are quite large, and some manufacturers bring the orifices nearer to the bed surface by using a fabricated steel tapered box arm rather than a circular pipe. A tapered arm also provides better hydraulic conditions and more uniform distribution of the applied sewage. Distributor speeds are about 1.5 r.p.m. for two-arm units and 3 r.p.m. for four-arm types.

24-28. Recirculation. The recirculation scheme will depend upon the number of filter stages, head available, and whether the raw sewage must be pumped. If the recirculated flow is taken from the sludge hopper of the final sedimentation tank the mixture of sewage and sludge is known as "underflow." This permits reduction in size of the final tank since the recirculated sewage can be disregarded in arriving at tank size. If the raw sewage is pumped it may be possible to run the underflow or recirculated effluent by gravity to the raw sewage wet well. It will, of course, be necessary to control the flow to the wet well by a manually adjusted valve or float valve in the wet well.

A recirculation scheme used at bio-filters is illustrated by Fig. 24-15. One-half the recirculated flow is taken from the filter effluent and returned to the primary tank, freshening the influent sewage and reducing scum. The rest of the recirculated flow is returned from the final effluent to the filter influent. This scheme permits the sedimentation tanks to be of identical size and smaller, since each provides detention for only one-half the recirculation. On the other hand, two pumps will be required. An alternative is to recirculate underflow to the primary influent.

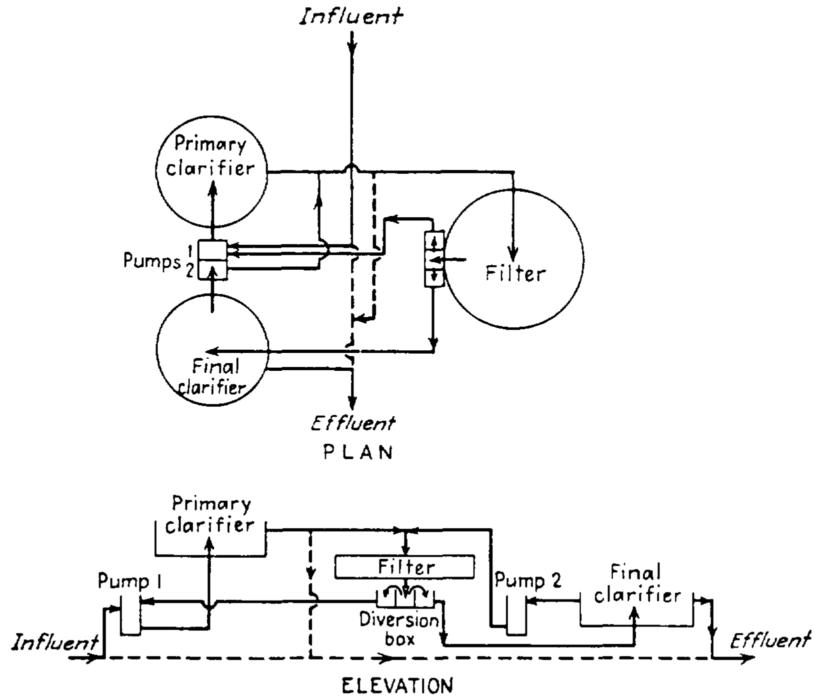

FIG. 24-15. Layout of a bio-filter, dual recirculation as of Fig. 24-5c, assuming that it is necessary to pump the influent. Dashed lines are bypasses. Sludge lines are not shown.

Many aero filters provide recirculation only during periods of low flow. Recirculation is then controlled by water level over an influent weir or Parshall flume or by a timed switch.

Recirculation of filter and settling tank effluents may be controlled by weirs which discharge into pipes connecting with pump wells. That part of a tank effluent which is recirculated may be taken off from a submerged launder in the tank to run either directly to the suction pipe of a pump or by gravity to a pump well. It is of course necessary to know the amount of sewage that is being recirculated. Meters are generally not used except in large plants, but this lack can be overcome by using the pumps as meters. This is done by carefully checking the performance of pumps as they are installed by measuring the drop or rise in one of the tanks when all other flow is stopped.

Pumps required for this service operate under low heads. Constant-speed units are generally used since two or more units can be installed if variation of recirculation is desired. For small plants one pump at each station should be sufficient. Recirculated liquid is always free from large solids and can be handled by centrifugal pumps. This also applies to underflow, in which the fine humus-like solids are much diluted. Submerged vertical pumps are preferred by many engineers for recirculation since they do not require dry wells. They may be controlled by floats in the wet wells or manually, but automatic cutoff should always be provided in case the wet well is emptied. In large plants propeller pumps, which operate efficiently under low heads, may be used.

24-29. Filter Media. The high liquid dosage makes choice of filter media even more important than for the low-rate filters. Statements as to durability made in Art. 24-23 also apply here. The larger sizes are preferred, say 2½ to 3½ in., and it is desirable that the material be uniform as to size and shape, i.e., cubical and free from flat pieces. Larger material, 3 to 4 in., is recommended for Accelo filters. Specifications used at Fort Worth, Tex.,[4] required that 100 per cent of the stone pass a 4-in. mesh; 90 to 100 per cent pass 3½-in.; 2-in. not over 10 per cent; 1½-in. not over 2 per cent. Square mesh was required. Other requirements were: Wear, L.A. abrasion test, A.S.T.M. C131-47, not over 30; sodium sulfate test, 20 cycles, loss not over 10 per cent; apparent specific gravity not less than 2.60; absorption, A.S.T.M. C127-42, not over 1 per cent. In order to eliminate dirt and small material it was required that immediately prior to final placing the stone be passed over a suitable screen with not less than 1-in. square openings. Special precautions were also required in placing the stone in the bed.[1,8] Usually the same size stone is used in both filters of a two-stage plant although smaller material, 1½ to 2 in., is sometimes used in the secondary filter. This will be satisfactory if these sizes are actually obtained and the second filter is not merely the recipient of all stone too small for the first filter, in which case clogging will probably result.

24-30. The Underdrain System. The description given in Art. 24-24 applies here. The designer must be careful, in view of the greater flows in the high-rate filters, that all drainage channels will care for the flow with sufficient freeboard to permit circulation of air. Usually designers are more concerned with ventilation, and stacks are placed at the upper ends of the rows of cover blocks, or a peripheral air channel may be placed just inside the wall and the stacks rise from this. Air ducts have also been built in the filter wall.

24-31. Bed Construction. High-rate filter beds are invariably circular. Bio-filters have a depth of medium of 3 to 4 ft., Accelo filters not less than 6 ft., and aero filters usually from 6 to 8 ft. Floors and walls are constructed as indicated in Art. 24-25.

24-32. Final Sedimentation. Sedimentation of filter effluent is even more important than for effluents of low-rate filters. The high liquid loading results in dislodgment from the stones of putrescible solids, which exert a considerable B.O.D. and will quickly reduce the dissolved oxygen of the effluent. The tank should have a detention period of 2 to 2½ hr. including the recirculated flow, with an overflow rate not to exceed 700 to 800 gal. per sq. ft. per day. Scum removal will not be necessary, but proper attention should be given to inlet and outlet details and prompt removal of sludge. Tanks will remove about 50 per cent of suspended solids and about 25 per cent of the B.O.D. of the influent.

OPERATION OF TRICKLING FILTER PLANTS

24-33. Operation and Maintenance. Where fixed nozzles are used a certain proportion will require cleaning each day. The orifices of rotary distributors may also require attention. The vent pipes and starting siphon of the dosing siphon may require cleaning and replacement. A common trouble is stoppage of the siphon vent.

Odors are rarely troublesome where rotary distributors are used, but the spray from fixed nozzles frequently releases hydrogen sulfide and other odorous gases into the air. The usual remedy is to chlorinate the sewage to prevent formation of hydrogen sulfide or to neutralize that already formed (Art. 27-4). Pooling of the surface of the filter may be caused by heavy algae growths. Chlorination of the sewage before it is applied to the bed frequently will kill the algae and cause unloading of the accumulated material. Adding copper sulfate (Art. 11-9) to the sewage will kill algae, and resting the bed is helpful.

24-34. Control of Psychoda. A small gray fly, *Psychoda alternata,* breeds in trickling filters, where the larvae live in the organic film. They are reported as less troublesome in high-rate filters, but at low-rate filters they are often so numerous as to constitute a nuisance, although they do not bite. A common method of control is to flood the filter bed for 24 hr. every week or two and thus drown the larvae. Accordingly beds should be designed so they can be flooded.

DDT has been used to control the Psychoda. Five pounds of DDT per acre of filter area, applied in kerosene solution added to the sewage over a period of 1 to 2 hr., has been found to be effective. Emulsions may also be used, but they should not contain the wetting agent Triton X-100 which is detrimental to the film. Other wetting agents, as Duponal and Nacconal, and solvents, as xylene and kerosene, and DDT itself are not injurious. Treatment may have to be repeated every 2 weeks. Adults can be controlled by spraying resting places with a 5 per cent solution, emulsion or suspension of DDT at the rate of 1 qt. per 250 sq. ft. Benzene hexachloride (10 per cent gamma isomer) has also been found useful at Akron, Ohio. It is used in 11 per cent concentration and applied at a rate of 4.5 gal. per acre at 4-week intervals by means of a surface spray providing enough pressure to get some penetration. The bed is placed out of operation for 2 hr. after dosing. The effluent is not adversely affected. This insecticide may be alternated with DDT if the flies become used to it. Some commercial insecticides[9] have also been found to be more promising than DDT in the control of Psychoda.

PROBLEMS

1. An intermittent sand filter installation has four beds, each ¼ acre in area. (*a*) What should be the capacity of the dosing tank in gallons to place a dose 2 in. deep on a single bed? (*b*) If the dosing tank has four alternating siphons, and the sewage flow is 100,000 gal. per day, what will be the resting period for a bed between doses? (*c*) If the dosing tank has a single siphon, and a bed is operated for a day at a time, how many doses will the bed receive in 24 hr? (*d*) What will be the shortest resting period between doses during that day, assuming a normal peak flow? (*e*) What should be the minimum capacity of the siphon used in order that it may empty the tank at peak flow?

2. A trickling filter plant is to be designed to treat 3 m.g.d. of sewage having a 5-day B.O.D. of 350 mg./l. A preliminary design is made for a high-rate trickling filter to include a primary sedimentation tank, primary and secondary filters, and intermediate and final sedimentation tanks. The allowable loading is 2,000 lb. of B.O.D. per acre-ft. Use a recirculation rate of 1. Assume primary sedimentation will reduce the B.O.D. by 35 per cent. (*a*) Determine the amount of filter media required. (*b*) If the filter depths are 4.5 ft. and half the filter media is in each of two circular filters, determine the filter diameters. (*c*) How many pounds of B.O.D. will be removed by the two filters and secondary and final tanks? (*d*) What will be the B.O.D. of the final effluent, in mg./l.?

3. If the sewage of Prob. 2 is to be applied to a standard filter (allowable load 450 lb. of B.O.D. per acre-ft.): (*a*) How much media will be required, in acre-feet? Assume 35 per cent of B.O.D. will be removed in the primary sedimentation tank. (*b*) What will be the daily removal of B.O.D., in pounds? (*c*) What will be the B.O.D. of the effluent, in mg./l.?

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NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CITY OF
AUBURN,
ALABAMA
LEE COUNTY

MAP INDEX

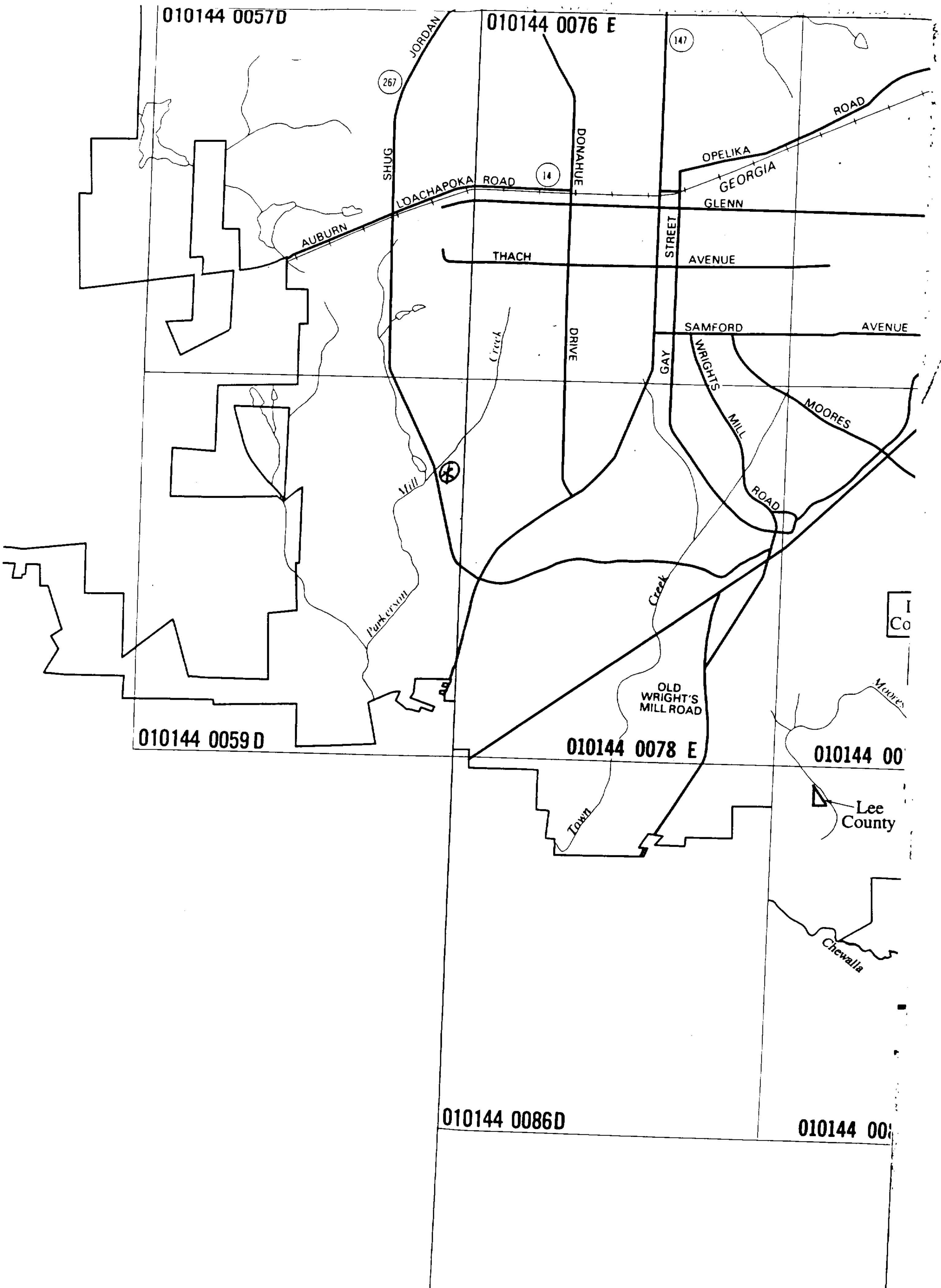
PANELS PRINTED: 24, 38, 39, 57, 59, 75, 76, 78, 79, 86, 87, 100

COMMUNITY-PANEL NUMBERS
010144 0023-0100

MAP REVISED:
MAY 17, 1993

Federal Emergency Management Agency

ATTACHMENT 10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SHUG
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OPELIKA
ROAD
GEORGIA
DONAHUE
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LOACHAPOKA ROAD
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GLENN
STREET
THACH
AVENUE
SAMFORD
AVENUE
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WRIGHTS
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Lee
County
Town
Chewalla
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NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

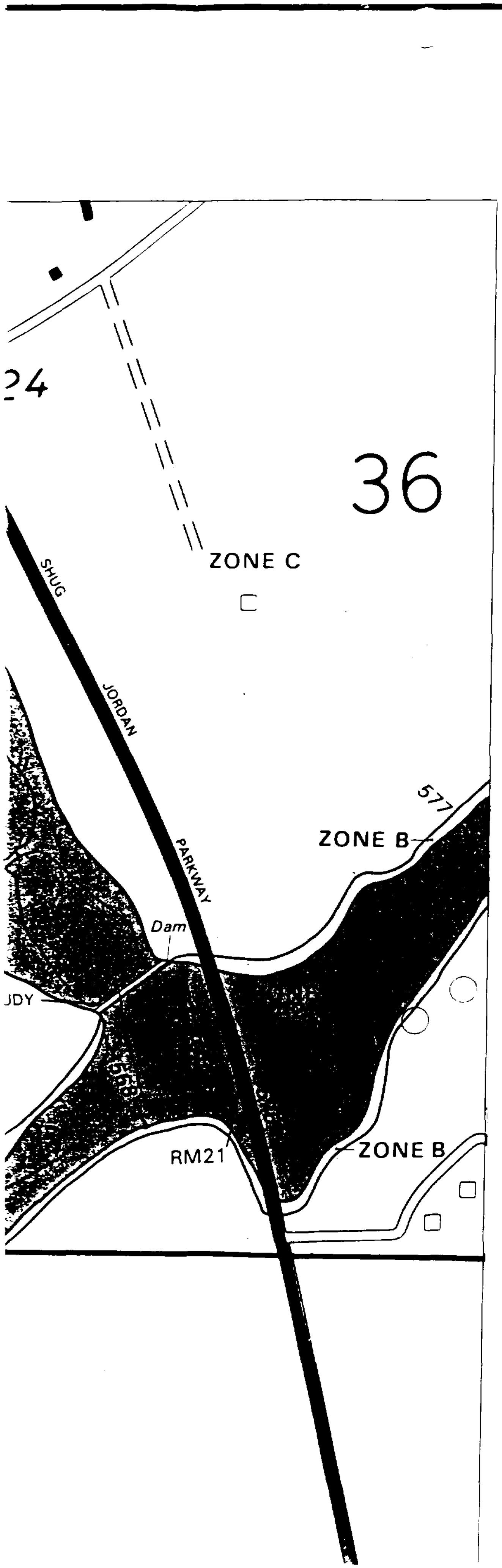
CITY OF
AUBURN, ALABAMA
LEE COUNTY

PANEL 59 OF 100
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
010144 0059 D

EFFECTIVE DATE:
SEPTEMBER 16, 1981

federal emergency management agency
federal insurance administration



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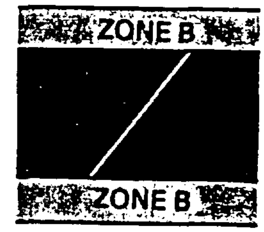

500-Year Flood Boundary

100-Year Flood Boundary

Zone Designations* With Date of Identification e.g., 12/2/74

100-Year Flood Boundary

500-Year Flood Boundary

Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7 ×
River Mile	• M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
JUNE 7, 1974

FLOOD HAZARD BOUNDARY MAP REVISIONS:

GEOLOGICAL SURVEY OF ALABAMA

Thomas J. Joiner
State Geologist

DIVISION OF WATER RESOURCES

Henry C. Barksdale
Chief

BULLETIN 113

7-DAY LOW FLOWS AND FLOW DURATION OF ALABAMA STREAMS THROUGH 1973

By

Eugene C. Hayes

Prepared by
United States Geological Survey
in cooperation with
Geological Survey of Alabama

University, Alabama
1978

Table 3.—*7-day low flows at partial-record stations*—Continued

Station no.	Stream and locality	Drainage area (sq mi)	Estimated 10-year 7-day low flow (cfs)	Estimated 10-year 7-day low flow (cfsm)	Estimated 2-year 7-day low flow (cfs)	Estimated 2-year 7-day low flow (cfsm)	Location of partial-record station
02407905	Paint Creek below Marble Valley, Ala.	16.0	0.0		0.7	0.044	In SE¼ sec. 35, T. 24 N., R. 16 E., at bridge crossing on County Road about 2 miles south of Marble Valley, Coosa County.
02408350	Hatchet Creek near Goodwater, Ala.	125	6.8	0.054	15	.12	In NW¼ sec. 9, T. 24 N., R. 20 E., at County Road 2 miles northwest of Goodwater, Coosa County.
02409300	Cargle Creek near Clanton, Ala.	10.3	—	—	.4	.039	In SW¼ sec. 6, T. 21 N., R. 16 E., at bridge crossing on County Road about 6.5 miles east of Clanton, Chilton County.
02409510	Chestnut Creek at Verbena, Ala.	37.9	.8	.021	2.3	.061	In SE¼ sec. 36, T. 21 N., R. 15 E., at U. S. Highway 31 at Verbena, Chilton County.
02409990	Sofkahatchee Creek near Central, Ala.	2.8	.04	.014	.16	.057	In NE¼ sec. 2, T. 19 N., R. 19 E., at County Road 2½ miles southwest of Central, Elmore County.
02410010	Gravel Creek near Central, Ala.	1.7	.06	.035	.18	.106	In SE¼ sec. 27, T. 20 N., R. 19 E., at County Road 3 miles west of Central, Elmore County.
02410020	Sofkahatchee Creek near Dexter, Ala.	15.8	.15	.009	1.1	.070	In SE¼ sec. 4, T. 19 N., R. 19 E., at County Road 1 mile northwest of Dexter, Elmore County.
02410030	Sofkahatchee Creek below John Bear Creek near Dexter, Ala.	23.4	.70	.030	2.0	.085	In N½ sec. 5, T. 19 N., R. 19 E., at County Road 3 miles northwest of Dexter, Elmore County.
02413475	Wedowee Creek near Wedowee, Ala.	51.1	8.0	.157	14	.274	In E½ sec. 34, T. 19 S., R. 11 E., at U. S. Highway 431, 1½ miles north of Wedowee, Randolph County.
02414020	Crooked Creek near Lineville, Ala.	35	7.0	.200	13	.371	In NE¼ sec. 19, T. 20 S., R. 9 E., at County Road 2 miles south of Lineville, Clay County.
02414522	High Pine Creek near Roanoke, Ala.	16.7	.5	.030	2.2	.132	In SE¼ sec. 28, T. 21 S., R. 12 E., at State Highway 22, 2 miles northwest of Roanoke, Randolph County.

02414580	High Pine Creek at Abanda, Ala.	74.1	3.9	.053	9.4	.127	In SW¼ sec. 2, T. 24 N., R. 25 E., at State Highway 77 at Abanda, Chambers County.
02414640	Finley Creek near Lafayette, Ala.	11.5	1.1	.096	2.5	.217	In N½ sec. 17, T. 22 N., R. 26 E., above pumping plant at County Road 3 miles west of Lafayette, Chambers County.
02414670	Chatahospee Creek near Lafayette, Ala.	73	4.0	.055	11	.151	In SW¼ sec. 27, T. 23 N., R. 25 E., at County Road 1 mile south of Trammel Crossroads, and 9 miles northwest of Lafayette, Chambers County.
02414760	Enitachopco Creek near Ashland, Ala.	21	4.6	.219	8.4	.4	In SW¼ sec. 31, T. 20 S., R. 8 E., at State Highway 9, 3 miles southwest of Ashland, Clay County.
02415500	Hillabee Creek near Alexander City, Ala.	284	25	.088	55	.194	In NE¼ sec. 16, T. 23 N., R. 22 E., at State Highway 22, 7 miles northeast of Alexander City, Tallapoosa County.
02416400	Unnamed tributary to Sandy Creek near Camp Hill, Ala.	13	—	—	1.7	.131	In SW¼ sec. 18, T. 21 N., R. 24 E., at U. S. Highway 280, 2 miles west of Camp Hill, Tallapoosa County.
02416495	Buck Creek near Walnut Hill, Ala.	19.7	—	—	8.0	.406	About the center of sec. 18, T. 21 N., R. 23 E., at bridge crossing on a County Road about 1.5 miles southwest of Dadeville, Tallapoosa County.
02417400	Stearns Creek near Seman, Ala.	1.3	.0		.1	.077	In SW¼ sec. 17, T. 20 N., R. 20 E., at County Road 2.5 miles southeast of Seman, Elmore County.
02418200	Sougahatchee Creek near Auburn, Ala.	53	7.8	.147	13	.245	In SW¼ sec. 12, T. 19 N., R. 25 E., at County Road 3 miles northwest of Auburn, Lee County.
02418260	Sougahatchee Creek near Notasulga, Ala.	164	8.0	.049	23	.140	In SE¼ sec. 26, T. 19 N., R. 23 E., Tallapoosa County, at County Road 4 miles northwest of Notasulga, Macon County.
02418750	Chewacla Creek near Auburn, Ala.	35	.7	.02	2.3	.066	In SE¼ sec. 18, T. 18, T. 18 N., R. 26 E., above Moores Mill Creek in Chewacla State Park, 4 miles south of Auburn, Lee County.
02418800	Chewacla Creek near Society Hill, Ala.	103	2.6	.025	8	.078	In NE¼ sec. 22, T. 17 N., R. 25 E., at U. S. Highway 80, 5 miles northwest of Society Hill, Macon County.
02418900	Uphapee Creek near Pleasant Hill, Ala.	256	3.2	.012	11	.043	In SE¼ sec. 21, T. 17 N., R. 24 E., at U. S. Highway 80, 2 miles southwest of Pleasant Hill, Macon County.

ENDANGERED SPECIES BY COUNTY LIST

STATE: ALABAMA

	CERTAINTY OF OCCURRENCE	GROUP	STATUS
COUNTY: LEE			
BAT, INDIANA *(Myotis sodalis)*	POSSIBLE	MAMMAL	E
TRILLIUM, RELICT *(Trillium reliquum)*	KNOWN	PLANT	E
WOODPECKER, RED-COCKADED *(Picoides borealis)*	POSSIBLE	BIRD	E
COUNTY: LIMESTONE			
BAT, GRAY *(Myotis grisescens)*	KNOWN	MAMMAL	E
BAT, INDIANA *(Myotis sodalis)*	POSSIBLE	MAMMAL	E
DARTER, BOULDER *(Etheostoma wapiti)*	KNOWN	FISH	E
DARTER, SLACKWATER *(Etheostoma boschungi)*	KNOWN	FISH	T
EAGLE, BALD *(Haliaeetus leucocephalus)*	KNOWN	BIRD	E
MUSSEL, PINK MUCKET PEARLY *(Lampsilis abrupta)(=orbiculata)*	KNOWN	CLAM	E
STORK, WOOD *(Mycteria americana)*	POSSIBLE	BIRD	E
COUNTY: LOWNDES			
BAT, INDIANA *(Myotis sodalis)*	POSSIBLE	MAMMAL	E
STORK, WOOD *(Mycteria americana)*	POSSIBLE	BIRD	E
COUNTY: MACON			
BAT, INDIANA *(Myotis sodalis)*	POSSIBLE	MAMMAL	E
MUSSEL, FINE-LINED POCKETBOOK *(Lampsilis altilis)*	KNOWN	CLAM	T
MUSSEL, OVATE CLUBSHELL *(Pleurobema perovatum)*	KNOWN	CLAM	E
MUSSEL, SOUTHERN CLUBSHELL *(Pleurobema decisum)*	KNOWN	CLAM	E
STORK, WOOD *(Mycteria americana)*	KNOWN	BIRD	E
WOODPECKER, RED-COCKADED *(Picoides borealis)*	KNOWN	BIRD	E

ALABAMA

FEDERALLY LISTED ENDANGERED/THREATENED SPECIES

amended 6/03/94

TAXA	STATUS	COMMON/SCIENTIFIC NAMES	DISTRIBUTION
Mammals (See Note on bottom of page 7)			
(7)	E	Red wolf* (*Canis rufus*)	Extirpated
	E	Florida panther* (*Felis concolor coryi*)	Extirpated
	E	Gray bat (*Myotis grisescens*)	Tennessee Valley to Conecuh Co.
	ECH	Indiana bat (*Myotis sodalis*)	Tennessee Valley to Shelby Co.
	ECH	Alabama beach mouse (*Peromyscus polionotus ammobates*)	Coastal, Baldwin Co.
	ECH	Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*)	Coastal, Baldwin Co.
	ECH	West Indian (Florida) manatee* (*Trichechus manatus*)	Coastal waters
Birds			
(9)	E	Ivory-billed woodpecker* (*Campephilus principalis*)	Extirpated
	T	Piping plover (*Charadrius melodus*)	Coastal
	ECH	American peregrine falcon (*Falco peregrinus anatum*)	Statewide
	T	Arctic peregrine falcon (*Falco peregrinus tundrius*)	Statewide
	T	Bald eagle (*Haliaeetus leucocephalus*)	Statewide
	E	Wood stork (*Mycteria americana*)	Statewide

TAXA	STATUS	COMMON/SCIENTIFIC NAMES	DISTRIBUTION
	E	Eskimo curlew (_Numenius borealis_	Possible migrant
	E	Red-cockaded woodpecker (_Picoides borealis_)	Statewide
	E	Bachman's warbler* (_Vermivora bachmanii_)	Probably Extirpated
Reptiles (9)			
	T	Loggerhead sea turtle (_Caretta caretta_)	Coastal waters
	T	Green sea turtle (_Chelonia mydas_)	Coastal waters
	ECH	Leatherback sea turtle (_Dermochelys coriacea_)	Coastal waters
	T	Eastern indigo snake (_Drymarchon corais couperi_)	Extreme southern counties
	ECH	Hawksbill sea turtle (_Eretmochelys imbricata_)	Coastal waters
	T	Gopher tortoise (_Gopherus polyphemus_)	Choctaw,Mobile, Washington Cos.
	E	Kemp's (Atlantic) Ridley sea turtle (_Lepidochelys kempii_)	Coastal waters
	E	Alabama red-bellied turtle (_Pseudemys alabamensis_)	Mobile, Baldwin, Monroe Cos.
	T	Flattened musk turtle (_Sternotherus depressus_)	Upper Black Warrior River system
Amphibians (1)	T	Red Hills salamander (_Phaeognathus hubrichti_)	South Central

TAXA	STATUS	COMMON/SCIENTIFIC NAMES	DISTRIBUTION
Fish (12)	T	Gulf sturgeon (*Acipenser oxyrhynchus desotoi*	Coastal Delta
	T	Pygmy sculpin (*Cottus pygmaeus*)	Calhoun County
	T	Blue shiner (*Cyprinella caerulea*)	Cherokee County
	TCH	Spotfin chub (*Cyprinella* (=*Hybopsis*) *monacha*)	Lauderdale County Colbert County
	TCH	Slackwater darter (*Etheostoma boschungi*)	Madison, Lauderdale, Limestone Counties
	E	Watercress darter (*Etheostoma nuchale*)	Jefferson County
	E	Boulder darter (*Etheostoma wapiti*)	Tennessee River tributaries
	E	Cahaba shiner (*Notropis cahabae*)	Cahaba River
	E	Palezone shiner (*Notropis* spp., cf. *procne*)	Jackson County Paint Rock River
	T	Goldline darter (*Percina aurolineata*)	Cahaba River system
	T	Snail darter (*Percina tanasi*)	Madison County Jackson County
	ECH	Alabama cavefish (*Speoplatyrhinus poulsoni*)	Lauderdale County

TAXA	STATUS	COMMON/SCIENTIFIC NAMES	DISTRIBUTION
Mollusks (37)	E	Anthony's riversnail (Anthearnia anthonyi)	Limestone Creek Limestone Co.
	E	Fanshell mussel (Cyprogenia stegaria	Tennessee River
	E	Dromedary pearly mussel (Dromus dromas)	Tennessee River
	E	Yellow-blossom pearly mussel (Epioblasma florentina)	Tennessee River
	E	Upland combshell mussel (Epioblasma metastriata)	Black Warrior, Cahaba, and Coosa River draina
	E	Purple cat's paw pearly mussel (Epioblasma obliquata)	Tennessee River
	E	Southern acornshell mussel (Epioblasma othcaloogenesis)	Upper Coosa and Cahaba River drainages
	E	Southern combshell mussel (Epioblasma penita)	Tombigbee River, Buttahatchie River
	E	Turgid-blossom pearly mussel (Epioblasma turgidula)	Tennessee River
	E	Fine-rayed pigtoe mussel (Fusconaia cuneolus)	Paint Rock River
	E	Shiny pigtoe mussel (Fusconaia edgariana)	Paint Rock River
	E	Cracking pearly mussel (Hemistena lata)	Tennessee River
	T	Fine-lined pocketbook mussel (Lampsilis altilis)	Statewide
	E	Pink mucket pearly mussel (Lampsilis abrupta)	Tennessee River, Paint Rock River
	T	Orange-nacre mucket (Lampsilis perovalis)	Tombigbee, Black Warrior Alabama, Cahaba drainage
	E	Alabama lamp pearly mussel (Lampsilis virescens)	Paint Rock River, Hurricane Creek

TAXA	STATUS	COMMON/SCIENTIFIC NAMES	DISTRIBUTION
	T	Alabama moccasinshell mussel (*Medionidus acutissimus*)	Alabama, Tombigbee, Cahaba, Coosa, Black Warrior drainage
	E	Coosa moccasinshell mussel (*Medionidus parvulus*)	Coosa, Cahaba, and Black Warrior drainages
	E	Ring pink mussel (*Obovaria retusa*)	Tennessee River
	E	Little-wing pearly mussel (*Pegias fabula*)	Tennessee River
	E	White wartyback pearly mussel (*Plethobasus cicatricosus*)	Tennessee River
	E	Orange-footed pearly mussel (*Plethobasus cooperianus*)	Tennessee River
	E	Clubshell (*Pleurobema clava*)	Tennessee River drainage
	E	Black clubshell mussel (*Pleurobema curtum*)	Tombigbee River
	E	Southern clubshell mussel (*Pleurobema decisum*)	Statewide except Mobile Delta
	E	Dark pigtoe mussel (*Pleurobema furvum*)	Black Warrior River drainage
	E	Southern pigtoe mussel (*Pleurobema georgianum*)	Coosa River drainage
	E	Flat pigtoe mussel (*Pleurobema marshalli*)	Tombigbee River
	E	Ovate clubshell mussel (*Pleurobema perovatum*)	Statewide
	E	Rough pigtoe mussel (*Pleurobema plenum*)	Tennessee River
	E	Heavy pigtoe mussel (*Pleurobema taitianum*)	Tennessee River
	T	Inflated heelsplitter mussel (*Potamilus inflatus*)	Black Warrior River to Mobile Bay

TAXA	STATUS	COMMON/SCIENTIFIC NAMES	DISTRIBUTION
	E	Triangular kidneyshell mussel (*Ptychobranchus greeni*)	Black Warrior, Cahaba, and Coosa River drainages
	E	Cumberland monkeyface pearly mussel (*Quadrula intermedia*)	Tennessee River
	E	Stirrup shell mussel (*Quadrula stapes*)	Tombigbee River, Sipsey River
	E	Pale lilliput pearly mussel (*Toxolasma* (=*Carunculina*) *cylindrella*)	Paint Rock River, Hurricane Creek
	E	Tulotoma snail (*Tulotoma magnifica*)	Coosa River System, Choccolocco Creek
Arthropods			
Crustacea (1)	E	Alabama cave shrimp (*Palaemonias alabamae*)	Madison County
Insecta (1)	E	American burying beetle (*Nicrophorus americanus*)	Statewide
Plants (18)	T	Little amphianthus (*Amphianthus pusillus*)	Chambers,Randolph Cos.
	T	Price's potato-bean (*Apios priceana*)	Marshall, Autauga Cos.
	E	Morefield's leather flower (*Clematis morefieldii*)	Madison Co.
	E	Alabama leather flower (*Clematis socialis*)	St. Clair, Cherokee Counties
	E	Leafy prairie-clover (*Dalea foliosa*)	Franklin, Morgan, Lawrence, Jefferson Cos.
	E	Gentian pinkroot *Spigelia gentianoides*	Bibb County
	T	Lyrate bladder-pod (*Lesquerella lyrata*)	Colbert, Franklin Cos.
	E	Pondberry (*Lindera melissifolia*)	Wilcox County

TAXA	STATUS	COMMON/SCIENTIFIC NAMES	DISTRIBUTION
	T	Mohr's Barbara's buttons (Marshallia mohrii)	Bibb, Cullman, Cherokee, Walker, Etowah Cos.
	T	American hart's-tongue fern (Phyllitis scolopendrium var. americana)	Morgan, Jackson Cos.
	E	Harperella (Ptilimnium nodosum	Cherokee, DeKalb Cos.
	T	Kral's water-plantain (Sagittaria secundifolia)	Cherokee, DeKalb Cos.
	E	Green pitcher plant (Sarracenia oreophila)	Marshall, Jackson, Etowah, DeKalb, Cherokee, Elmore, Russell Cos.
	E	Alabama canebrake pitcher-plant (Sarracenia rubra alabamensis)	Autuga, Chilton, Elmore Cos.
	E	American chaffseed (Schwalbea americana)	
	T	Alabama streak-sorus fern (Thelypteris pilosa var. alabamensis)	Winston County
	E	Relict trillium (Trillium reliquum)	Henry, Lee, Bullock Cos.
	E	Tennessee yellow-eyed grass (Xyris tennesseensis)	Franklin Co.

Total Animal Species: 77 (not including 5 species of whales)
Plant Species: 18

* = Not believed to occur in Alabama
Status: E = endangered
T = threatened
CH = critical habitat has been designated

The American alligator is neither threatened nor endangered, but designated so because of similarity of appearance to the threatened American crocodile.

NOTE: There are 5 endangered species of whales found in coastal waters of the southeastern states. These include the finback whale (Balaenoptera physalus), the humpback whale (Megaptera novaeangliae), the right whale (Eubalaena glacialis), the sei whale (Balaenoptera borealis), and the sperm whale (Physeter catodon). It is possible, though unlikely, that they could appear in Alabama coastal waters.

07/12/95

Federally Listed Species By State

ALABAMA

(E=Endangered; T=Threatened; CH=Critical Habitat determined)

Mammals	General Distribution
Bat, gray (Myotis grisescens) - E	Extreme North, East
Bat, Indiana (Myotis sodalis) - E	Extreme North
Manatee, West Indian (Trichechus manatus) - E	Coastal waters
Mouse, Alabama beach (Peromyscus polionotus ammobates) - E,CH	Coastal; Baldwin
Mouse, Perdido Key beach (Peromyscus polionotus trissyllepsis) - E,CH	Perdido Key
Panther, Florida (Felis concolor coryi) - E	Entire state
Whale, finback (Balaenoptera physalus) - E	Coastal waters
Whale, humpback (Megaptera novaeangliae) - E	Coastal waters
Whale, right (Eubalaena glacialis) - E	Coastal waters
Whale, sei (Balaenoptera borealis) - E	Coastal waters
Whale, sperm (Physeter catodon) - E	Coastal waters

Birds	
Eagle, bald (Haliaeetus leucocephalus) - T	Entire State
Falcon, American peregrine (Falco peregrinus anatum) - E	North
Plover, piping (Charadrius melodus) - T	Coast
Warbler, Bachman's (Vermivora bachmanii) - E	Entire State
Wood, stork (Mycteria americana) - E	Entire State
Woodpecker, ivory-billed (Campephilus principalis) - E	South, West Central
Woodpecker, red-cockaded (Picoides [=Dendrocopos] borealis) - E	Entire State

Reptiles	
Alligator, American (Alligator mississippiensis) - T (S/A)*	Coastal plain

*Alligators are biologically neither endangered nor threatened. For law enforcement purposes they are classified as "Threatened due to Similarity of Appearance." Alligator hunting is regulated in accordance with State law.

	General Distribution
Snake, eastern indigo (*Drymarchon corais couperi*) - T	South
Tortoise, gopher (*Gopherus polyphemus*) - T	Choctaw, Mobile, Washington Counties
Turtle, Alabama red-bellied (*Pseudemys alabamensis*) - E	Mobile River system; Baldwin and Mobile Counties
Turtle, flattened musk (*Sternotherus depressus*) - T	Upper Black Warrior River system
Turtle, Kemp's (Atlantic) ridley (*Lepidochelys kempii*) - E	Coastal waters
Turtle, green (*Chelonia mydas*) - T	Coastal waters
Turtle, hawksbill (*Eretmochelys imbricata*) - E	Coastal waters
Turtle, leatherback (*Dermochelys coriacea*) - E	Coastal waters
Turtle, loggerhead (*Caretta caretta*) - T	Coastal waters

Amphibians

Salamander, Red Hills (*Phaeognatus hubrichti*) - T	Covington, Conecuh, Butler, Crenshaw, Monroe Counties

Arthropods

Shrimp, Alabama cave (*Palaemonias alabamae*) - E	Madison County

Fishes

Cavefish, Alabama (*Speoplatyrhimus poulsoni*) - E, CH	Lauderdale County
Darter, boulder (*Etheostoma* [*Nothonotus*] sp) - E	Lower Elk River System, Limestone County
Darter, goldline (*Percina aurolineata*) - T	Cahaba River System

	General Distribution
Darter, palezone (*Notropis* sp., cf. *procne*) - E	Paint Rock River, Jackson County
Darter, slackwater (*Etheostoma boschungi*) - T, CH	Madison, Lauderdale, Limestone Counties
Darter, snail (*Percina tanasi*) - T	Madison and Jackson Counties (Paint Rock R.)
Darter, Watercress (*Etheostoma nuchale*) - E	Jefferson County
Sculpin, pygmy (*Cottus pygmaeus*) - T	Coldwater Spring and Coldwater Spring run
Shiner, blue (*Cyprinella caerulea*) -T	Upper Coosa River System: Weogufka and Choccolocco Creeks, lower reach of Little River
Shiner, cahaba (*Notropis cahabae*) - E	Cahaba River: Bibb, Shelby, Perry County
Sturgeon, Gulf (*Acipenser axyrhynchus*) - T	Alabama River System, Mobile River System
Mollusks	
Acornshell, southern (*Epioblasma othcaloogensis*) - E	Coosa River drainage
Clubshell, ovate (*Pleurobema perovatum*) - E	Sipsey River in the Tombigbee River drainage; Blackwater Creek and Locust Fork in the Black Warrior drainage; Chewacia Creek in the Tallapoosa drainage
Clubshell, southern (*Pleurobema decisum*) - E	Bogue Chitto Creek, Alabama River drainage; East Fork Tombigbee and Sipsey Rivers, Tombigbee River drainage; Chewacia Creek, Tallapoosa River drainage; Coosa River drainage, Conasauga River and Shoal and Kelly Creeks; Cahaba River
Combshell, southern or penitent mussel (*Epioblasma penitent*) - E	Cahaba, Coosa Rivers

	General Distribution
Combshell, upland (Epioblasma metastriata) - E	Upper Black Warrior and Cahaba River drainages
Kidneyshell, triangular (Plychobranchus greeni) - E	Headwaters of the Sipsey Fork and Little Warrior River, Black Warrior River drainage; Cahaba River
Moccasinshell, Alabama (Medionidus acutissimus) - T	Sipsey Rivers in the Tombigbee River drainage; Brushy Creek and Rush Creek, Black Warrior River drainage
Moccasinshell, Coosa (Medionidus parvulus) - E	Coosa River and tributaries; Cahaba River; Sipsey Fork, Black Warrior River
Mucket, orange-nacre (Lampsilis perovalis) - T	Headwaters of the Sipsey Fork; Sipsey and Little Cahaba Rivers
Mussel, Alabama lamp pearly (Lampsilis virescens) - E	Paint Rock River, Estill Fork, Hurricane Creek, Larkin Fork
Moccasinshell, Coosa (Medionidus parvulus) - E	Cahaba River; Sipsey Fork of the Black Warrior River; Coosa River and tributaries; Little River
Mussel, fine-rayed pigtoe pearly (Fusconaia cuneolus) - E	Paint Rock River
Mussel, inflated heelsplitter (Potamilius inflatus) - T	Tombigbee and Black Warrior Rivers
Mussel, flat pigtoe (Pleurobema marshalli) - E	Tombigbee River (bendway in Sumter County)
Mussel, orange-footed pimpleback (Plethobasus cooperianus) - E	Tennessee River
Mussel, pale lilliput pearly (Toxolasma [Carunculina] cylindrella) - E	Paint Rock River, Estill Fork, Hurricane Creek

	General Distribution
Mussel, pink mucket pearly (Lampsilis abrupta [= obiculata]) - E	Tennessee and Paint Rock Rivers
Mussel, rough pigtoe pearly (Pleurobema plenum) - E	Tennessee River
Mussel, shiny pigtoe pearly (Fusconaia edgariana) - E	Paint Rock River
Mussel, stirrup shell (Quadrula stapes) - E	Tombigbee River (bendway in Sumter County), and Sipsey River
Pigtoe, dark (Pleurobema furvum) - E	Black Warrior River, headwaters of the Sipsey Fork and Upper North River drainage
Pigtoe, heavy or Judge Tait's mussel (Pleurobema taitianum) - E	Tombigbee River (bendway in Sumter County), Sipsey River
Pigtoe, southern (Pleurobema georgiana) - E	Coosa River, Shoal Creek in the Choccolocco Creek drainage
Pocketbook, fine-lined (Lampsilis altilis) - T	Sipsey Fork headwaters, Black Warrior River drainage; Tatum Creek, Alabama River drainage; Little Cahaba, Cahaba River drainage; Kelly Creek and Shoal Creek in the Coosa River drainage and Main Channel; Chewacla and Opintlocco Creeks, Tallapoosa drainage
Riversnail, Anthony's (Atheamia anthonyi) - E	Limestone Creek in Limestone County
Snail, Tulotoma (Tulotoma magnifica) - E	Coosa River tributaries (Kelly Creek, St. Clair and Shelby Counties; Weogufka and Hatchet Creeks, Coosa County; Ohatchee Creek, Calhoun County; and between Jordan Dam and Wetumpka, Elmore County)

Plants	General Distribution
Amphianthus pusillus (little amphianthus) - T	Randolph, Chambers Counties
Apios priceana (Price's potato-bean) - T	Madison, Autauga, and Marshall Counties
Clematis morefieldii (Morefield's leather flower) - E	Madison County
Clematis socialis (Alabama leather flower) - E	St. Clair, Cherokee Counties
Dalea foliosa (= Petalostemum foliosum) (Leafy prairie-clover) - E	Franklin, Morgan, Lawrence, and Jefferson Counties
Marshallia mohrii (Mohr's Barbara's buttons) - T	Bibb, Cherokee, Etowah Counties
Phyllitis scolopendrium var. Americana (American hart's tongue fern) - T	Jackson, Morgan Counties
Ptilimnium nodosum (harperella) - E	Dekalb County
Sagittaria secundifolia (Kral's water plaintain) - T	Dekalb, Cherokee Counties
Sarracenia oreophila (green pitcher plant) - E	Cherokee, Dekalb, Jackson, Marshall, Etowah Counties
Sarracenia rubra ssp. alabamensis (Alabama canebrake pitcher-plant) - E	Autauga, Chilton, Elmore
Spigelia gentianoides (gentian pinkroot) - E	Montgomery County
Thelypteris pilosa var. alabamensis (Alabama streak-sorus fern) - T	Sipsey Fork tributary of Black Warrior River, Winston County
Trillium reliquum (relict trillium) - E	Henry, Lee Counties
Xyris tennesseensis (Tennessee yellow-eyed grass) - E	Franklin County

ENDANGERED AND THREATENED SPECIES

OF THE

SOUTHEASTERN UNITED STATES

(THE RED BOOK)

Introduction Section, Volume 1

Prepared by:

U.S. Fish and Wildlife Service
Southeast Region
Atlanta, Georgia

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RELICT TRILLIUM

Trillium reliquum Freeman

FAMILY: Lily

STATUS: Endangered, Federal Register, April 4, 1988

DESCRIPTION AND REPRODUCTION: A perennial herb, relict trillium differs from other sessile-flowered trilliums in three respects (1) decumbent or S-curved stems, distinctively-shaped anthers, and by the color and shape of its leaves. This plant flowers in early spring, with flowers that are greenish to brownish purple or sometimes pure yellow. Its fruit is an oval-shaped, berry-like capsule which matures in early summer. Like other trillium plants, this species dies back to its tuberous rhizome after the fruit matures.

RANGE AND POPULATION LEVEL: A total of 21 plant populations exist in Alabama (four populations); Georgia (14 populations); and South Carolina (3 populations). Population numbers range from 20 to several thousand plants, but at least 10 of these populations support less than 200 plants. Alabama's populations are located in Henry, Lee, and Bullock Counties. South Carolina has populations In Aiken and Edgefield Counties. Georgia's populations are found in Clay, Lee, Macon, Early, Talbot, and Columbia Counties. One former population in Georgia is known to have been extirpated. Although the historic range of relict trillium is unknown, the existing populations were probably much larger.

HABITAT: Relict trillium thrives best in mature, moist, undisturbed hardwood forests. Most sites are free from fire. The soils on which this plant occurs range from alluvial sands to rocky clays, but they all have a high organic content in their upper layer.

REASONS FOR CURRENT STATUS: Most relict trillium sites are threatened by logging, road construction, agricultural conversion, or residential and industrial development. Many sites are close to expanding urban areas. Some sites are being converted for pine monoculture, pastures, or row crops. Stone quarrying has adversely impacted at least one population, and stone, clay, or sand quarrying is a potential threat to a few others. Two human-introduced, weedy vines are also a serious threat. Japanese honeysuckle and kudzu are encroaching on relict trillium at many of its sites.

MANAGEMENT AND PROTECTION: Some priority recovery goals described in the species' recovery plan include: (1) Determining habitat protection priorities and developing landowner agreements; (2) Planning and implementing neccessary management techniques; (3) Defining the criteria for what constitutes a self-sustaining population and determining the size of area each population needs to be self-sustaining; (4) Reestablishing populations within suitable habitat; and, (5) Maintaining a cultivated source of plants and providing for long-term seed storage.

At present, 18 of the 21 existing populations are privately owned. One population in Henry County, Alabama is owned by the U.S. Army Corps of Engineers; part of another in Aiken County, South Carolina is owned by the South Carolina Department of Wildlife and Marine Resources (SCWMRC). The segment owned by the SCWMRC is part of the largest known site (50,000 to 100,000 plants). This site, located in Aiken and Edgefield Counties, South Carolina, is owned by private, State, and municipal landowners. To date, State Natural Heritage Programs in all three States have contacted most of the landowners of the populations. An informal agreement has been reached with the municipal goverment and one of the private landowners that own portions of the largest population. They have agreed to protect the plants on their respective lands. In addition, the SCWMRC is protecting its population segment (500 plants) as a natural area. The U.S. Army Corps of Engineers is protecting the population on its property in Alabama. Efforts involving State conservation agencies and the U.S. Fish and Wildlife Service are underway to locate new populations.

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SOUTHERN CLUBSHELL

Pleurobema decisum

FAMILY: Unionidae

STATUS: Endangered, Federal Register, March 17, 1993

DESCRIPTION: The southern clubshell is a medium-sized mussel about 70 millimeters (2.8 inches) long, with a thick shell, and heavy hinge plate and teeth. The shell outline is roughly rectangular, produced posteriorly with the umbos terminal with the anterior margin, or nearly so. The posterior ridge is moderately inflated and ends abruptly with little development of the posterior slope at the dorsum of the shell. The periostracum (epidermis) is yellow to yellow-brown with occasional green rays or spots on the umbo in young specimens.

RANGE AND POPULATION LEVEL: The southern clubshell was described from the Alabama River, Alabama. Except for the Mobile Delta, this species was formerly known from every major stream system in the Mobile River basin. This includes the Alabama River and Bogue Chitto Creek in Alabama; Tombigbee River and tributaries (Buttahatchee, East Fork Tombigbee, and Sipsey Rivers and Bull Mountain, Luxapalila, and Lubbub Creeks) in Mississippi and Alabama; Black Warrior River, Alabama; Cahaba and Little Cahaba Rivers, Alabama; two Tallapoosa tributaries, Uphapee and Chewacla Creeks, Alabama; and the Coosa River and tributaries (Oostanaula, Conasauga, Etowah, Chatooga, and Coosawattee Rivers and Kelly, Talladega and Shoal Creeks) in Alabama, Georgia, and Tennessee.

HABITAT: This species inhabits sand/gravel/cobble substrate in small rivers and large streams.

REASONS FOR CURRENT STATUS: Habitat modification, sedimentation, and water quality degradation represent the major threats to the southern clubshell. This species is not known to tolerate impoundments. More than 1,000 miles of large and small river habitat in the Mobile River drainage has been impounded for navigation, flood control, water supply, and/or hydroelectric production purposes. Other forms of habitat modification such as channelization, channel clearing, de-snagging, and gravel mining result in stream bed scour and erosion, increased turbidity, reduction of groundwater levels, sedimentation, and changes in the aquatic community structure.

Water quality degradation from both point and non-point sources affects the southern clubshell. Point sources of water quality degradation include municipal and industrial effluents, and coalbed methane produced water discharge. Non-point sources include runoff from cultivated fields, pastures, private wastewater effluents, agricultural feed-lots and poultry houses, active and abandoned coal mine sites, and highway and road drainage. Stream discharge from these sources may result in decreased dissolved oxygen concentration, increased acidity and conductivity, and other changes in water chemistry which may impact mussels and/or their host fishes.

MANAGEMENT AND PROTECTION EFFORTS: All existing State and Federal legislation and regulations must be enforced to protect the southern clubshell. These would include surface mining laws, and water quality and stream alteration regulations. Research needs include habitat requirements and the identification of fish hosts.

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Department of the Interior. U.S. Fish and Wildlife Service. March 17, 1993. Endangered and Threatened Wildlife and Plants: Endangered Status for eight Freshwater Mussels and Threatened Status for Three Freshwater Mussels in the Mobil River Drainage. Federal Register 58:50. pp. 14330-14340.

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OVATE CLUBSHELL

Pleurobema perovatum

FAMILY: Unionidae

STATUS: Endangered, Federal Register, March 17, 1993

DESCRIPTION: The ovate clubshell is a small to medium-sized mussel that rarely exceeds 50 millimeters (2 inches) in length. The shell is oval to elliptical in shape, and has nearly terminal, inflated umbos. The posterior ridge is well-developed, broadly rounded, and often concave. The posterior slope is produced well beyond the posterior ridge. Periostracum (epidermis) color varies from yellow to dark brown, and occasionally has broad green rays that may cover most of the umbo and posterior ridge. The nacre is white.

RANGE AND POPULATION LEVEL: The ovate clubshell was described from small streams in Greene County, Alabama. The species occurred in the Tombigbee River and tributaries (Buttahatchee and Sipsey Rivers; Luxapalila, Coalfire and Lubbub Creeks) in Alabama and Mississippi; Black Warrior River and tributaries (Locust Fork, Village, Prairie, Big Prairie, Brushy, and Blackwater Creeks) in Alabama; Alabama River in Alabama; Cahaba River and the tributary Buck Creek in Alabama; Chewacla, Uphapee and Opintlocco Creeks in the Tallapoosa drainage, Alabama; and the Coosa River and tributaries (Conasauga and Etowah Rivers, and Holly Creek). Currently, localized populations are known from the Buttahatchee River, Mississippi, and Sipsey River, Alabama, in the Tombigbee River drainage; Blackwater Creek and Locust Fork in the Black Warrior drainage, Alabama; and Chewacla Creek in the Tallapoosa drainage, Alabama. Population levels are low.

HABITAT: The species inhabits sand/gravel/cobble substrate in small rivers and large streams.

REASONS FOR CURRENT STATUS: Habitat modification, sedimentation, and water quality degradation represent the major threats to the ovate clubshell. This species is not known to tolerate impoundments. More than 1,000 miles of large and small river habitat in the Mobile River drainage has been impounded for navigation, flood control, water supply, and/or hydroelectric production purposes. Other forms of habitat modification such as channelization, channel clearing and de-snagging, and gravel mining result in stream bed scour and erosion, increased turbidity, reduction of groundwater levels, sedimentation, and changes in the aquatic community structure.

Water quality degradation from both point and non-point sources affects the ovate clubshell. Point sources of water quality degradation include municipal and industrial effluents. Non-point sources include runoff from cultivated fields, pastures, private wastewater effluents, agricultural feed-lots and poultry houses, active and abandoned coal mine sites, and highway and road drainage. Stream discharge from these sources may result in decreased dissolved oxygen concentration, increased acidity and conductivity, and other changes in water chemistry which may impact mussels and/or their host fishes.

MANAGEMENT AND PROTECTION EFFORTS: All existing State and Federal legislation and regulations must be enforced to protect the ovate clubshell. These would include surface mining laws, and water quality and stream alteration regulations. Research needs include habitat requirements and the identification of fish hosts.

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Department of the Interior. U.S. Fish and Wildlife Service. March 17, 1993. Endangered and Threatened Wildlife and Plants: Endangered Status for eight Freshwater Mussels and Threatened Status for Three Freshwater Mussels in the Mobil River Drainage. Federal Register 58:50. pp. 14330-14340.

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FINE-LINED POCKETBOOK

Lampsilis altilis

FAMILY: Unionidae

STATUS: Threatened, Federal Register, March 17, 1993

DESCRIPTION: The fine-lined pocketbook is a medium-sized mussel which is sub-oval in shape and rarely exceeds 100 millimeters (4 inches) in length. The ventral margin of the shell is angled posteriorly in females, resulting in a pointed posterior margin. The periostracum (epidermis) is yellow-brown to blackish and has fine rays on the posterior half. The nacre is white, becoming iridescent posteriorly.

RANGE AND POPULATION LEVEL: The fine-lined pocketbook was described from the Alabama River near Claiborne, Monroe County, Alabama. This species was historically recorded from the Sipsey and Buttahatchee Rivers in the Tombigbee River drainage, Alabama and Mississippi; Black Warrior River and tributaries (Sipsey Fork, Brushy and Capsey Creeks) in Alabama; Cahaba River and tributaries (Little Cahaba and Buck Creeks) in Alabama; Alabama River and a secondary tributary, Tatum Creek, in Alabama; Chewacla and Opintlocco Creeks in the Tallapoosa River drainage in Alabama; and the Coosa River and tributaries (Choccolocco and Talladega Creeks) in Alabama. The current distribution of the fine-lined pocketbook appears to be limited to the headwaters of the Sipsey Fork of the Black Warrior River drainage in Alabama; Tatum Creek in the Alabama River drainage, Alabama; Little Cahaba River in the Cahaba River drainage, Alabama; Conasauga River in Georgia and Tennessee; Kelly Creek and Shoal Creek in the Coosa River drainage and one site in the main channel, Alabama; and Chewacla and Opintlocco Creeks in the Tallapoosa drainage in Alabama. Populations are small and localized within these drainages.

HABITAT: Currently restricted to high quality creek habitat, the species is found on stable sand/gravel/cobble substrate in moderate to swift currents.

REASONS FOR CURRENT STATUS: Habitat modification, sedimentation, and water quality degradation represent the major threats to the fine-lined pocketbook. This species is not known to tolerate impoundments. More than 1,000 miles of large and small river habitat in the Mobile River drainage has been impounded for navigation, flood control, water supply, and/or hydroelectric production purposes. Other forms of habitat modification such as channelization, channel clearing and de-snagging, and gravel mining result in stream bed scour and erosion, increased turbidity, reduction of groundwater levels, sedimentation, and changes in the aquatic community structure.

Water quality degradation from both point and non-point sources affects the fine-lined pocketbook. Point sources of water quality degradation include municipal and industrial effluents, and coalbed methane produced water discharge. Non-point sources include runoff from cultivated fields, pastures, private wastewater effluents, agricultural feed-lots and poultry houses, active and abandoned coal mine sites, and highway and road drainage. Stream discharge from these sources may result in decreased dissolved oxygen concentration, increased acidity and conductivity, and other changes in water chemistry which may impact mussels and/or their host fishes.

MANAGEMENT AND PROTECTION EFFORTS: The U.S. Forest Service has funded mussel surveys in streams under their jurisdiction. They have expressed a desire to conduct life history studies on this species.

REFERENCES

Department of the Interior. U.S. Fish and Wildlife Service. March 17, 1993. Endangered and Threatened Wildlife and Plants: Endangered Status for eight Freshwater Mussels and Threatened Status for Three Freshwater Mussels in the Mobil River Drainage. Federal Register 58:50. pp. 14330-14340.

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RED-COCKADED WOODPECKER

Picoides (=*Dendrocopos*) *borealis* (Vieillot)

FAMILY: Picidae

STATUS: Endangered, Federal Register, October 13, 1970

DESCRIPTION: The red-cockaded woodpecker is 18 to 20 centimeters long with a wing span of 35 to 38 centimeters. There are black and white horizontal stripes on its back, and its cheeks and underparts are white. Its flanks are black streaked. The cap and stripe on the side of the neck and the throat are black. The male has a small red spot on each side of the black cap. After the first post fledgling molt, fledgling males have a red crown patch. This woodpecker's diet is composed mainly of insects which include ants, beetles, wood-boring insects, caterpilars, and corn ear worms if available. About 16 to 18 percent of the diet includes seasonal wild fruit.

REPRODUCTION AND DEVELOPMENT: Egg laying occurs during April, May, and June with the female utilizing her mate's roosting cavity for a nest. Maximum clutch size is seven eggs with the average being three to five eggs. From egg laying to fledging requires about 38 days, and then another several weeks are needed before the young become completely independent. Most often, the parent birds and some of their male offspring from previous years form a family unit called a group. A group may include one breeding pair and as many as seven other birds. Commonly, these groups are comprised of three to five birds. Rearing the young birds becomes a shared responsibility of the group. However, a single pair can breed successfully without the benefit of the helpers.

RANGE AND POPULATION LEVEL: This bird's range is closely tied to the distribution of southern pines. Historically, the red-cockaded woodpecker occurred from East Texas and Oklahoma, to Florida, and North to New Jersey. The present distribution is similar, except the species has been extirpated from Missouri, Maryland, and New Jersey. The remaining populations are fragmented into isolated, island populations. Current population level is estimated at 4,500 groups or 10,000 to 12,000 birds.

HABITAT: Open stands of pines with a minimum age of 80 to 120 years, depending on the site, provide suitable nesting habitat. Longleaf pines (*Pinus palustris*) are most commonly used, but other species of southern pine are also acceptable. Dense stands (stands that are primarily hardwoods, or that have a dense hardwood understory) are avoided. Foraging habitat is provided in pine and pine hardwood stands 30 years old or older with foraging preference for pine trees 10 inches or larger in diameter. In good, well-stocked, pine habitat, sufficient foraging substrate can be provided on 80 to 125 acres.

Roosting cavities are excavated in living pines, and usually in those which are infected with a fungus producing what is known as red-heart disease. The cavity tree ages range from 63 to 300 plus years for longleaf, and 62 to 200 plus years for loblolly and other pines. The aggregate of cavity trees is called a cluster and may include 1 to 20 or more cavity trees on 3 to 60 acres. The average cluster is about 10 acres. Completed cavities in active use have numerous, small resin wells which exude sap. The birds keep the sap flowing apparently as a cavity defense mechanism against rat snakes and possibly other predators. The territory for a group averages about 200 acres, but observers have reported territories running from a low of around 60 acres, to an upper extreme of more than 600 acres. The expanse of territories is related to both habitat suitability and population density.

REASONS FOR CURRENT STATUS: The red-cockaded woodpecker was described by Audubon as being abundant in 1839, but it received little study until around 1970, when investigations began to indicate that the species could be headed for extinction. The decline is attributed primarily to the reduction of pine forest with trees 80 years old and older and to the encroachment of hardwood midstory due to fire supression in clusters. Living pines in this age group, infected with red-heart disease, generally provide the specialized nesting sites which these woodpeckers require.

MANAGEMENT AND PROTECTION: Some of the recommendations included in the species' recovery plan are: (1) Survey, monitor, and assess the status of individual populations and the species; (2) Implement protection and management of nesting and foraging habitat on Federal lands; (3) Encourage protection and management on private lands; (4) Conduct research on habitat needs and management, population dynamics, and genetic variation, and (5) Inform and involve the public.

The U.S. Forest Service, the U.S. Fish and Wildlife Service, and the U.S. Army are all working on comprehensive management and recovery guidelines for their respective federal properties (national forests, national wildlife refuges, and army installations) where the bird will be recovered. Additionally, the issues surrounding protection and management of red-cockaded woodpeckers on private lands are being addressed through a three-part private lands strategy which includes a procedural manual for private landowners, Statewide Habitat Conservation Plans, and Memorandums of Agreement with industrial forest landowners.

In January 1993, the third annual red-cockaded woodpecker symposium was held. Proceedings will be available through the Fish and Wildlife Service in 1994.

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WOOD STORK

Mycteria americana

FAMILY: Ciconiidae

STATUS: Endangered - U.S. Breeding Population (Federal Register, February 28, 1984)

DESCRIPTION: Wood storks are large, long-legged wading birds, about 50 inches tall, with a wingspan of 60 to 65 inches. The plumage is white except for black primaries and secondaries and a short black tail. The head and neck are largely unfeathered and dark gray in color. The bill is black, thick at the base, and slightly decurved. Immature birds are dingy gray and have a yellowish bill.

FEEDING HABITS: Small fish from 1 to 6 inches long, especially topminnows and sunfish, provide this bird's primary diet. Wood storks capture their prey by a specialized technique known as grope-feeding or tacto-location. Feeding often occurs in water 6 to 10 inches deep, where a stork probes with the bill partly open. When a fish touches the bill it quickly snaps shut. The average response time of this reflex is 25 milliseconds, making it one of the fastest reflexes known in vertebrates. Wood storks use thermals to soar as far as 80 miles from nesting to feeding areas. Since thermals do not form in early morning, wood storks may arrive at feeding areas later than other wading bird species such as herons. Energy requirements for a pair of nesting wood storks and their young is estimated at 443 pounds of fish for the breeding season (based on an average production of 2.25 fledglings per nest).

REPRODUCTION AND DEVELOPMENT: The wood stork is a highly colonial species usually nesting in large rookeries and feeding in flocks. Age at first breeding is 4 years. Nesting periods vary geographically. In South Florida, wood storks lay eggs as early as October and fledge in February or March. However, in north and central Florida, Georgia, and South Carolina, storks lay eggs from March to late May, with fledging occurring in July and August. Nests are frequently located in the upper branches of large cypress trees or in mangroves on islands. Several nests are usually located in each tree. Wood storks have also nested in man-made structures. Storks lay two to five eggs, and average two young fledged per successful nest under good conditions.

RANGE AND POPULATION LEVEL: The current population of adult birds is difficult to estimate, since not all nest each year. Presently, the wood stork population is believed to number 11,000 adults. Recent United States breeding is restricted to Florida, Georgia, and South Carolina. The birds formerly bred in most of the southeastern United States and Texas. Another distinct, non-endangered population breeds from Mexico to northern Argentina.

Storks from both populations move northward after breeding, as far as Arkansas and Tennessee in the Mississippi Valley, and North Carolina on the Atlantic coast. There have been occasional sightings in all States east of the Mississippi River, and sporadic sightings in some States west of the Mississippi and in Ontario.

HABITAT: Storks are birds of freshwater and brackish wetlands, primarily nesting in cypress or mangrove swamps. They feed in freshwater marshes, narrow tidal creeks, or flooded tidal pools. Particularly attractive feeding sites are depressions in marshes or swamps where fish become concentrated during periods of falling water levels.

REASONS FOR CURRENT STATUS: The United States breeding population of the wood stork declined from an estimated 20,000 pairs in the 1930's to about 10,000 pairs by 1960. Since 1978, fewer than 5,000 pairs have bred each year. If this trend were to continue, the United States breeding population would be near extinction by the turn of the century (Ogden and Patty 1981). The decline is believed to be due primarily to the loss of suitable feeding habitat (Ogden and Patty 1981). This is especially true of south Florida rookeries where repeated nesting failures have occurred despite protection of the rookeries. Feeding areas in south Florida have decreased by about 35 percent since 1900 due to man's alteration of wetlands. Additionally, man-made levees, canals, and floodgates have greatly changed natural water regimes in south Florida.

Wood storks have a unique feeding technique and require higher prey concentrations than other wading birds. Optimal water regimes for the wood stork involve periods of flooding, during which prey (fish) populations increase, alternating with dryer periods, during which receding water levels concentrate fish at higher densities coinciding with the stork's nesting season. Loss of nesting habitat (primarily cypress swamps) may be affecting wood storks in central Florida, where nesting in non-native trees and in man-made impoundments has been occurring recently. Less significant factors known to affect nesting success include prolonged drought and flooding, raccoon predation on nests, and human disturbance of rookeries.

MANAGEMENT AND PROTECTION: Large, fully protected colonies in south Florida (Everglades National Park and Corkscrew Swamp Sanctuary) experienced frequent nesting failures in recent years. This is due to adverse water management practices in south Florida. As a result of such drainage, many nesting storks have shifted colony sites to managed or impounded wetlands in central and north Florida. Water management plans must take the needs of the wood stork into account if the species is to survive in these areas.

Water level management may also be crucial at rookeries. Flooding may be necessary to stimulate nesting and prevent predators from destroying nests. Periodic drying also may be necessary to prevent trees from dying and to allow recruitment of new trees.

At a minimum, for continued survival of the United States population of wood storks, currently occupied nesting, roosting, and foraging habitat must be protected from further loss or degradation. A prerequisite for recovery of the population is the restoration and enhancement of suitable habitat throughout the mosaic of habitat types used by this species. Recovery efforts for the wood stork would be more effective with a complete understanding of population biology, movement patterns of United States and neighboring populations of storks, foraging ecology and behavior, the importance of roost sites, and the possible impacts of contaminants.

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INDIANA BAT

Myotis sodalis (Miller and Allen)

FAMILY: Vespertilionidae

STATUS: Endangered throughout its range, Federal Register, March 11, 1967

DESCRIPTION: The Indiana bat is a medium-sized myotis, closely resembling the little brown bay (Myotis lucifugus) but differing in coloration. Its fur is a dull grayfish chestnut rather than bronze, with the basal portion of the hairs of the back dull lead colored. This bat's underparts are pinkish to cinnamon, and its hind feet smaller and more delicate than in M. lucifugus. The calcar (heel of the foot) is strongly keeled.

Little is known of the this bat's diet beyond the fact that it consists of insects. Females and juveniles forage in the airspace near the foliage of riparian and floodplain trees. Males forage the densely wooded area at tree top height (LaVal et al., 1976, 1977).

RANGE AND POPULATION LEVEL: The Indiana bat occurs in the Midwest and eastern United States from the western edge of the Ozark region in Oklahoma, to southern Wisconsin, east to Vermont, and as far south as northern Florida. In summer it is apparently absent south of Tennessee; in winter it is apparently absent from Michigan, Ohio, and northern Indiana where suitable caves and mines are unknown. About 500,000 individuals of this species still exist.

REPRODUCTION AND DEVELOPMENT: This bat has a definite breeding period that usually occurs during the first 10 days of October. Mating takes place at night on the ceilings of large rooms near cave entrances. Limited mating may also occur in the spring before the hibernating colonies disperse.

Hibernating colonies disperse in late March and most of the bats migrate to more northern habitat for the summer. However, some males remain in the hibernating area during this period and form active bands which wander from cave to cave.

Limited observations indicate that birth and development occur in very small, widely scattered colonies consisting of 25 or so females and their young. Birth usually takes place during June with each female bearing a single offspring. About 25 to 37 days are required for development to the flying stage and the beginning of independent feeding.

Migration to the wintering caves usually begins in August. Fat reserves depleted during migration are replenished largely during the month of September. Feeding continues at a diminishing rate until by late November the population has entered a definite state of hibernation.

The hibernating bats characteristically form large, tight, compact clusters. Each individual hangs by its feet from the ceiling. Every 8 to 10 days hibernating individuals awaken to spend an hour or more flying about or to join a small cluster of active bats elsewhere in the cave before returning to hibernation.

HABITAT: Limestone caves are used for winter hibernation. The preferred caves have a temperature averaging 37 degrees to 43 degrees Fahrenheit in midwinter, and a relative humidity averaging 87 percent. Summer records are rather scarce. A few individuals have been found under bridges and in old buildings, and several maternity colonies have been found under loose bark and in the hollows of trees. Summer foraging by females and juveniles is limited to riparian and floodplain areas. Creeks are apparently not used if riparian trees have been removed. Males forage over floodplain ridges and hillside forests and usually roost in caves. Foraging areas average 11.2 acres per animal in midsummer.

CRITICAL HABITAT: The following caves have been designated as Critical Habitat within the Southeast Region:

Tennessee: White Oak Blowhole Cave, Blount County
Kentucky: Bat Cave, Carter County
Coach Cave, Edmonson County

REASONS FOR CURRENT STATUS: The decline is attributed to commercialization of roosting caves, wanton destruction by vandals, disturbances caused by increased numbers of spelunkers and bat banding programs, use of bats as laboratory experimental animals, and possibly insecticide poisoning. Some winter hibernacula have been rendered unsuitable as a result of blocking or impeding air flow into the caves and thereby changing the cave's climate. The Indiana bat is nearly extinct over most of its former range in the northeastern states, and since 1950, the major winter colonies in caves of West Virginia, Indiana, and Illinois have disappeared. A high degree of aggregation during winter makes the species vulnerable. During this period approximately 87 percent of the entire population hibernates in only seven caves.

MANAGEMENT AND PROTECTION: The original Indiana bat recovery plan was approved in 1976, and a revised plan was approved on October 14, 1983, Some of the major recovery goals include: (1) Preserving critical winter habitat by securing primary caves and mines and restricting entry; (2) Initiating an information and education program; and, (3) Monitoring population levels and habitat (to include an evaluation of pesticide effects).

To date, the primary conservation efforts have been to control access of people by the installation of properly designed gates across cave entrances. Some gating has already been accomplished on Federal and State lands. Gating of all seven of the major wintering hibernacula would provide protection for about 87 percent of the population. Some privately-owned caves in Missouri and West Virginia are being negotiated for public acquisition. The National Speological Society and the American Society of Mammologists are taking measures within their respective organizations to promote conservation of the Indiana bat.

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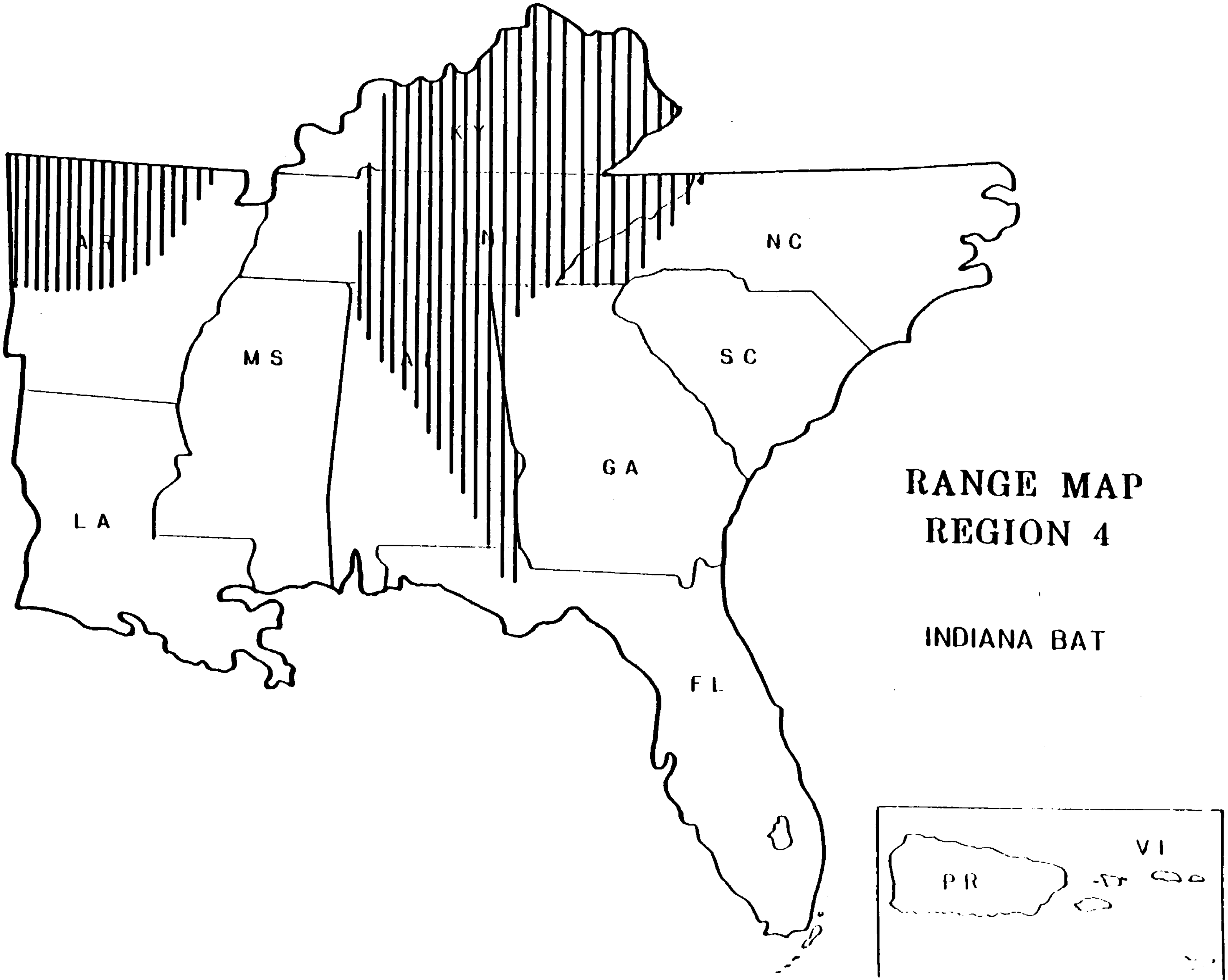

RANGE MAP
REGION 4

INDIANA BAT

GRAY BAT

Myotis grisescens

FAMILY: Vespertilionidae

STATUS: Endangered throughout its range, Federal Register, April 28, 1976

DESCRIPTION: The largest member of its genus in the eastern United States, the gray bat weighs from 7 to 16 grams. Its forearm ranges from 40 to 46 millimeters in length (U.S. Fish and Wildlife Service, 1982). One feature which distinguishes this species from all other eastern bats is its uni-colored dorsal fur. The other bats have bi- or tri-colored fur on their backs. Also, the gray bat's wing membrane connects to the foot at the ankle instead of at the base of the first toe, as in other species of Myotis (U.S. Fish and Wildlife Service 1982). For a short period after molt in July or August, gray bats are dark gray; but their fur usually bleaches to russet between molts. This difference in fur color is especially apparent in females during their reproductive season in May or June. Little is known about the actual feeding habits of gray bats. However, limited observations indicate that the majority of insects eaten are aquatic species, particularly mayflies.

REPRODUCTION AND DEVELOPMENT: Upon arrival at their wintering caves in early fall, the mature females enter estrus and are inseminated by sexually active males. The offspring, one per female, are born the following June when the colonies have migrated to their summer range. The period from birth to weaning covers about 2 months. During this time the colonies are usually segregated into maternity caves, where the young are reared, and into bachelor caves which house the adult males and yearlings of both sexes. By August, all of the juveniles are flying and there is a general mixing and dispersal of the colony over the summer range. Fall migration begins around the first of September and is generally complete by early November.

RANGE AND POPULATION LEVEL: Populations are found mainly in Alabama, northern Arkansas, Kentucky, Missouri, and Tennessee, but a few occur in northwestern Florida, western Georgia, southwestern Kansas, south Indiana, south and southwestern Illinois, northeastern Oklahoma, northeastern Mississippi, western Virginia, and possibly western North Carolina. Distribution within range was always patchy, but fragmentation and isolation of populations have been a problem over the past 3 decades.

The gray bat population was estimated to be about 2.25 million in 1970; however, in 1976 a census of 22 important colonies in Alabama and Tennessee revealed an average decline of more than 50 percent (Tuttle, unpublished MS). Due to protective increases taken at high priority colony sites in the late 1970's and throughout the 1980's, the declines have been arrested at some major sites and those populations are now stable or in some cases are increasing.

HABITAT: Gray bat colonies are restricted entirely to caves or cave-like habitats. During summer the bats are highly selective for caves providing specific temperature and roost conditions. Usually these caves are all located within a kilometer of a river or reservoir. In winter they utilize only deep, vertical caves having a temperature of 6-11 degrees Centigrade. Consequently, only a small proportion of the caves in any area are or can be used regularly. There are nine known caves that are believed to house roughly 95 percent of the hibernating population.

One-way migrating distance between winter and summer caves may vary from as little as 10 miles to well over 200. Banding studies indicate the bats occupy a rather definite summer range with relation to the roosting site and nearby foraging areas over large streams and reservoirs. Summer colonies show a preference for caves not over 1.2 miles from the feeding area.

REASONS FOR CURRENT STATUS: Gray bat colonies roost only in caves and cave-like habitats. Human disturbance and vandalism may have been primarily responsible for the decline. Disturbance of a maternity colony may cause thousands of young to be dropped to the cave floor where they perish; excessive disturbance may cause a colony to completely abandon a cave. Other factors which contributed to the decline included pesticide poisoning, natural calamities such as flooding and cave-ins, loss of caves due to inundation by man-made impoundments, and possibly a reduction in insect prey over streams that have been degraded through excessive pollution and siltation. Improper cave gating or cave commercialization have also contributed to some population declines.

MANAGEMENT AND PROTECTION: Blowing Wind Cave in northern Alabama, the most important summer cave known for gray bats, has been acquired by the U.S. Fish and Wildlife Service and a gate has been placed across the entrance. Fern Cave, the largest known gray bat hibernaculum, has also been purchased by the Fish and Wildlife Service and is being managed for protection of the bats. Many other measures have been taken for protection of this species throughout its range. Some additional conservation measures needed include: (1) purchase and protection, through proper gating and restricted usage, of other gray bat caves; (2) education of spelunkers and other cave visitors who may unintentionally disturb the species; and, (3) continuation of Federal efforts to reduce persistent pesticides in the environment.

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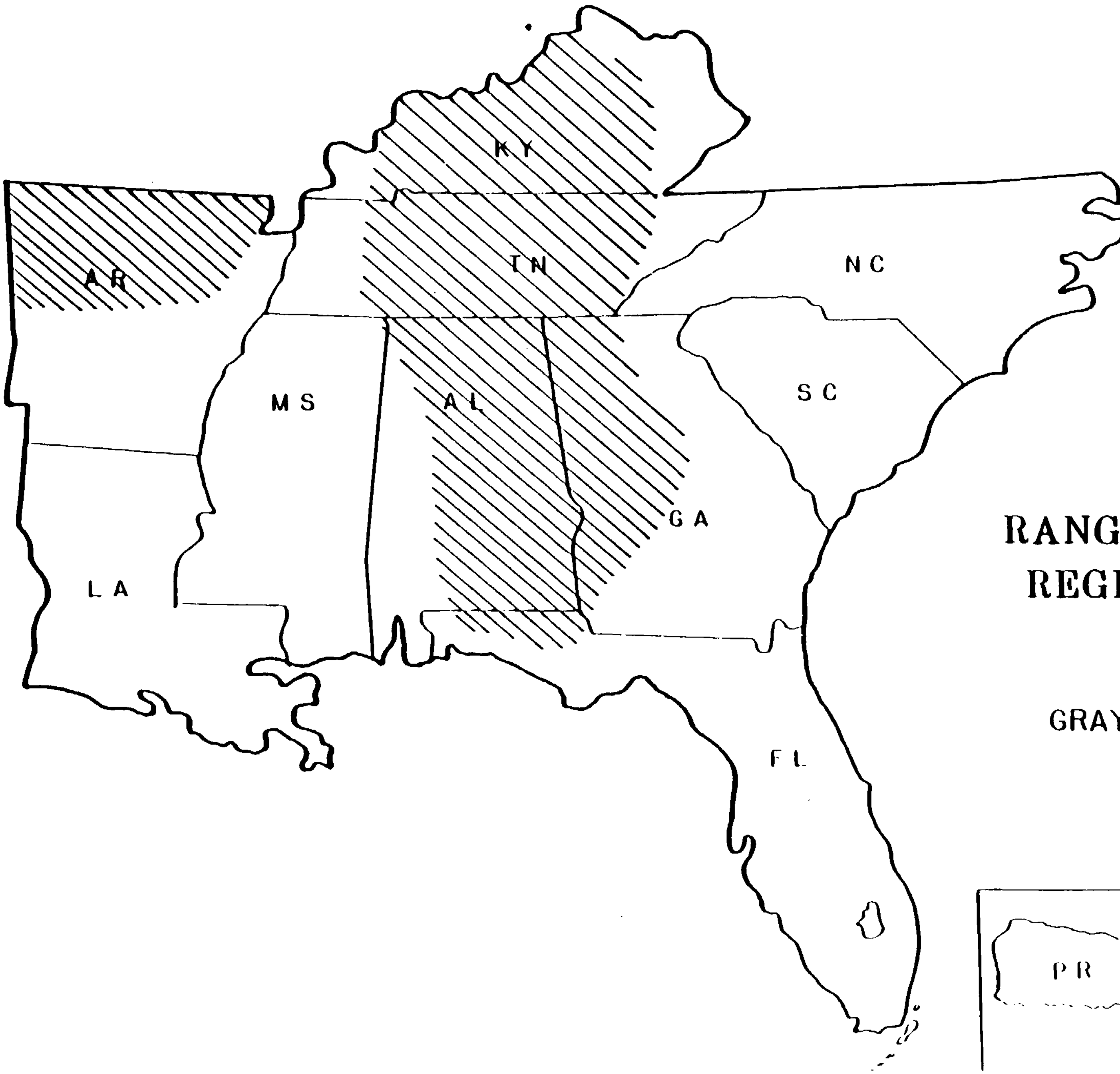
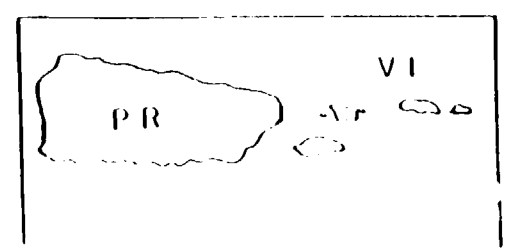


RANGE MAP
REGION 4

GRAY BAT



LAND DIVISION - HAZARDOUS WASTE BRANCH - SITE ASSESSMENT UNIT: TELEPHONE CONVERSATION RECORD

Date:	December 16, 1996	ASWWTP 6477
Time:	2:47 pm (I called)	
Conservation with:	Secretary	(334) 887-2100
Facility or Company:	Superintendent's Office Auburn City Schools Auburn, AL 36830	
Regarding:	Checking on status of Boykie School- listed on topographic map	

(2:47 pm): Boykie School is no longer in existence.

B. Temple

Bat